You can download all instructions, catalogs and certificates for SITRANS T free of charge at the following Internet address:
www.usa.siemens.com/temperature

Overview

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
Temperature transmitter for head mounting					
	**SITRANS TH100** Transmitters for Pt100 • Two-wire system	Zone 2 and zone 1	Zone 2, zone 1 and zone 0	2/4	SIPROM T
	**SITRANS TH200** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Two-wire system • Universal	Zone 2 and zone 1	Zone 2, zone 1 and zone 0	2/8	SIPROM T
	**SITRANS TH300** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Two-wire system • Universal • HART	Zone 2 and zone 1	Zone 2, zone 1 and zone 0	2/15	SIMATIC PDM
	**SITRANS TH400** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.9 V • Fieldbus transmitters • PROFIBUS PA • FOUNDATION fieldbus	Zone 2, zone 1 and zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	2/22	SIMATIC PDM for TH 400 with PROFIBUS PA
Temperature transmitters for rail mounting					
	**SITRANS TR200** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Two-wire system • Universal	Zone 2, zone 1 and zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	2/28	SIPROM T
	**SITRANS TR300** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • Two-wire system • Universal • HART	Zone 2, zone 1 and zone 21	Zone 2, zone 1, zone 0, zone 21, zone 20	2/35	SIMATIC PDM

	Application	Mounting of transmitter with Ex protection		Page	Software for parameterization
		Transmitter	Sensor		
	**SITRANS TW** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples, DC voltages and DC currents for: • Four-wire system	Safe area	Zone 1, zone 0, zone 21, zone 20	2/42	SIMATIC PDM
Temperature transmitters for field mounting					
	**SITRANS TF280** Transmitter for connection to resistance-based sensor • In field enclosure for heavy industrial use • battery-operated • WirelessHART	-	-	2/54	Local operation via buttons SIMATIC PDM local with HART modem and wireless via WirelessHART
	**SITRANS TF** Transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 1.1 V • In field enclosure for heavy industrial use • HART, Universal	Zone 2 and zone 1	Zone 2, zone 1 and zone 0	2/59	depending on the installed TH200/TH300 transmitter
	**SITRANS TF** Fieldbus transmitters for connection to resistance thermometers, resistance-based sensors, thermocouples and DC voltages up to 0.8 V • In field enclosure for heavy industrial use • PROFIBUS PA • FOUNDATION fieldbus	Zone 2 and zone 1	Zone 2, zone 1 and zone 0	2/68	SIMATIC PDM for PROFIBUS PA
Field indicator for 4 to 20 mA signals					
	**SITRANS TF** Field indicator for 4 to 20 mA signals Display of units can be user-defined	Zone 2 and zone 1	-	2/59	--

	Type	Description	Page
Temperature sensors			
	**SITRANS TS500** Temperature Sensor Assemblies Include thermowell, sensor, head and transmitters	• Integrated temperature assemblies • Include thermowell, sensor, head and transmitter in single model number. • Various options include configuration, calibration and certificates.	2/75

SITRANS TH100 two-wire system (Pt100)

Overview

The SITRANS TH100 dispenses with electrical isolation and universal sensor connection to provide a low-cost alternative for Pt100 measurements.

For the parameterization, the SIPROM T software is used in combination with the modem for SITRANS TH100/TH200.

Its extremely compact design makes the SITRANS TH100 ideal for the retrofitting of measuring points or for the use of analog transmitters.

The transmitter is available as a non-Ex version as well as for use in potentially explosive atmospheres.

Benefits

- Two-wire transmitter
- Assembly in connection head type B (DIN 43729) or larger, or on a standard DIN rail
- Can be programmed, which means that the sensor connection, measuring range, etc. can also be programmed
- Intrinsically-safe version for use in potentially explosive areas

Application

Used in conjunction with Pt100 resistance thermometers, the SITRANS TH100 transmitters are ideal for measuring temperatures in all industries. Due to its compact size it can be installed in the connection head type B (DIN 43729) or larger.

The output signal is a direct current from 4 to 20 mA that is proportional to the temperature.

Parameterization is implemented over the PC using the parameterization software SIPROM T and the modem for SITRANS TH100/TH200. If you already have a "modem for SITRANS TK" (Article No. 7NG3190-6KB), you can continue using this to parameterize the SITRANS TH100.

Transmitters of the "intrinsically-safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

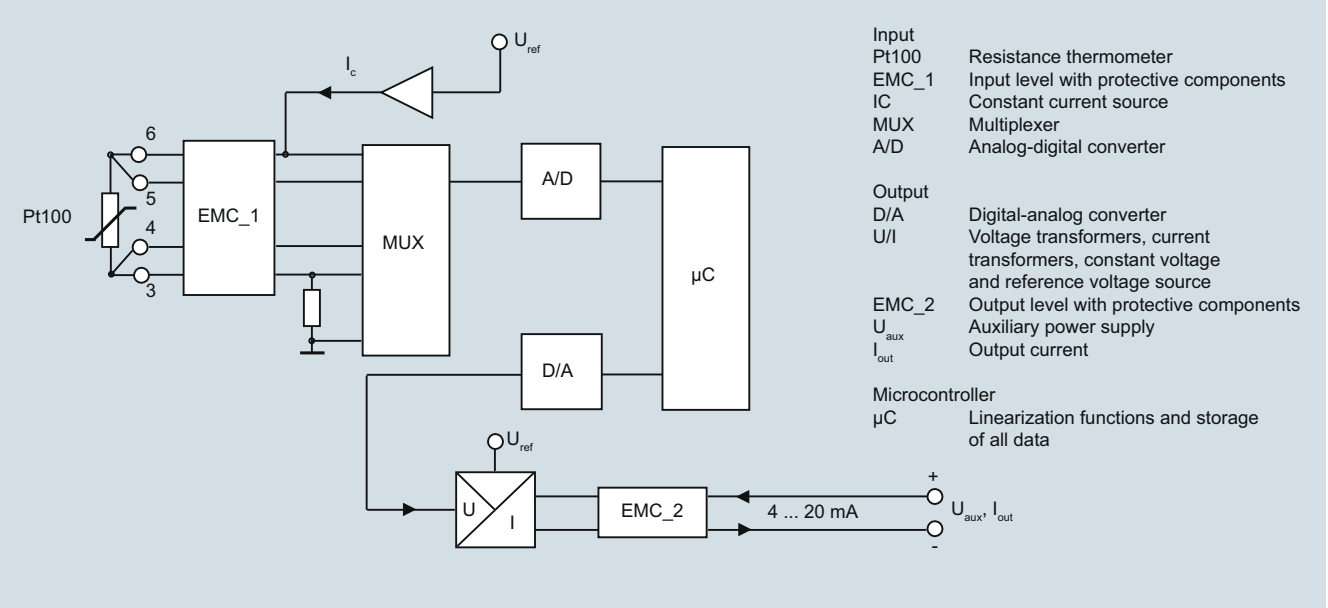
Function

Mode of operation

The measured signal supplied by a Pt100 resistance thermometer (2, 3 or 4-wire system) is amplified in the input stage. The voltage, which is proportional to the input variable, is then converted into digital signals by a multiplexer in an analog/digital converter. They are converted in the microcontroller in accordance with the sensor characteristics and further parameters (measuring range, damping, ambient temperature etc.).

The signal prepared in this way is converted in a digital/analog converter into a load-independent direct current of 4 to 20 mA.

An EMC filter protects the input and output circuits against electromagnetic interferences.



SITRANS TH100, function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	PT100 to IEC 60751
Characteristic curve	Temperature-linear
Type of connection	2-, 3- or 4-wire circuit
Resolution	14 bit
Measuring accuracy	
• Span <250 °C (450 °F)	< 0.25 °C (0.45 °F)
• Span >250 °C (450 °F)	< 0.1 % of span
Repeatability	< 0.1 °C (0.18 °F)
Measuring current	approx. 0.4 mA
Measuring cycle	< 0.7 s
Measuring range	-200 ... +850 °C -328 ... +1562 °F)
Measuring span	25 ... 1050 °C (77 ... 1922 °F)
Unit	°C or °F
Offset	programmable: -100 ... +100 °C (-180 ... +180 °F)
Line resistance	Max. 20 Ω (total from feeder and return conductor)
Noise rejection	50 and 60 Hz
Output	
Output signal	4 ... 20 mA, two-wire
Auxiliary power	8.5 ... 36 V DC (30 V for Ex ia and ib; 32 V for Ex nL/ic; 35 V for Ex nA)
Max. load	$(U_{aux}$ - 8.5 V)/0.023 A
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 ... 20.5 mA)
Error signal (following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default range: 3.6 mA or 22.8 mA)
Damping time	0 ... 30 s (default value: 0 s)
Protection	Against reversed polarity
Resolution	12 bit
Accuracy at 23 °C (73.4 °F)	< 0.1 % of span
Temperature effect	< 0.1 %/10 °C (0.1 %/18 °F)
Effect of auxiliary power	< 0.01 % of span/V
Effect of load impedance	< 0.025 % of max. span/100 Ω
Long-term drift	• < 0.025 % of the max. span in the first month • < 0.035 % of the max. span after one year • < 0.05 % of the max. span after 5 years
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	98 %, with condensation
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Construction	
Weight	50 g
Dimensions	See dimensional drawing
Material	Molded plastic
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 05 ATEX 2049X
• "Intrinsic gas safety" type of protection	II 1 G Ex ia IIC T6/T4 II (1) 2 G Ex ib [ia Ga] IIC T6/T4 Gb II (1) 3 G Ex ic [ia Ga] IIC T6/T4 Gc II 3 G Ex ic IIC T6/T4 Gc
• "Non-sparking" type of protection	II 3 G Ex nA IIC T6/T4 Gc II 3 G Ex nA[ic] IIC T6/T4 Gc
• "Intrinsic dust safety" type of protection	II 1 D Ex ia IIIC T115 °C Da
Explosion protection FM for USA **and** Canada ($_cFM_{US}$)	
• FM approval	PID 3024169
• Degree of protection	IS Cl I, II, III, Div 1, GP ABCDEFG T4/T5/T6 Cl I, ZN 0,1 AEx ia IIC T4/T5/T6 NI Cl I, II, III, Div 2, GP ABCDFG T4/T5/T6 Cl I, ZN 2, NI IIC T4/T5/T6
Other certificates	GOST, NEPSI, PESO
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; can also be used in connection with RS 232 modem under Windows 95, 98 and 98SE

SITRANS TH100 two-wire system (Pt100)

Selection and Ordering data

	Article No.
SITRANS TH100 temperature transmitters for Pt100 for installation in connection head, type B (DIN 43729), two-wire system, 4 ... 20 mA, programmable, without electrical isolation	
• Without explosion protection	**7NG3211-0NN00**
• With explosion protection "Intrinsic safety" type of protection and for zone 2	
- to ATEX	**7NG3211-0AN00**
- to FM ($_cFM_{US}$)	**7NG3211-0BN00**
Further designs	Order code
Add "**-Z**" to Article No. and specify Order code(s)	
Test report (5 measuring points)	**C11**
Customer-specific programming Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point no. (TAG), max. 8 characters	**Y17**[2]
Measuring point descriptor, max. 16 characters	**Y23**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Special differing customer-specific programming, specify in plain text	**Y09**[4]
Fail-safe value 3.6 mA (instead of 22,8 mA)	**U36**[2]
Accessories	Article No.
Modem for SITRANS TH100, TH200, TR200 and TF with TH200 incl. SIPROM T parameterization software With USB connection	**7NG3092-8KU**
MiniDVD for temperature measuring instruments With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	**A5E00364512**
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	**7NG3092-8KA**
Connecting cable 4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	**7NG3092-8KC**

1) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
2) For this selection, Y01 or Y09 must also be selected.
3) For this selection, Y01 must also be selected.
4) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Supply units see Chapter "Supplementary Components".

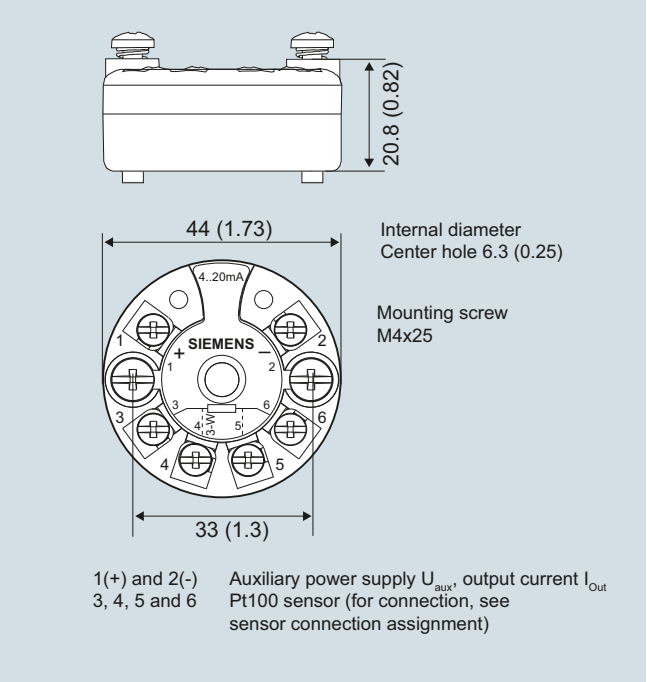
Ordering example

7NG3211-0NN00-Z Y01+Y23+U03
Y01: -10 ... +100 °C
Y23: TICA1234HEAT

Factory setting:

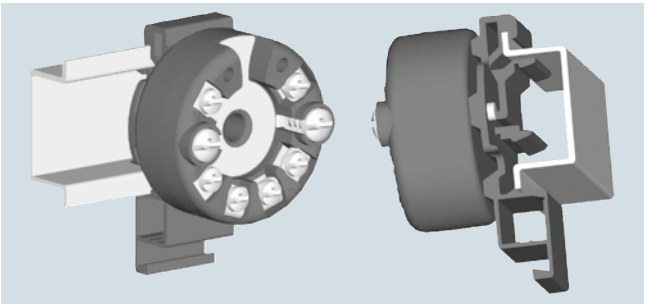
- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 … 100 °C (32 … 212 °C)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 C (0 °F)
- Damping 0.0 s

Dimensional drawings

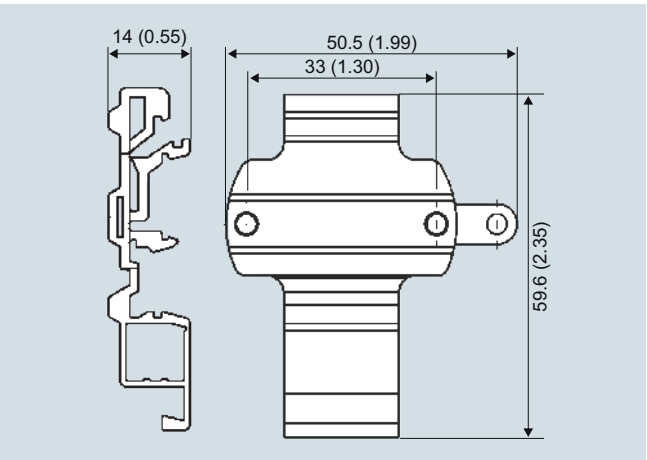


SITRANS TH100, dimensions in mm (inch)

Mounting on DIN rail

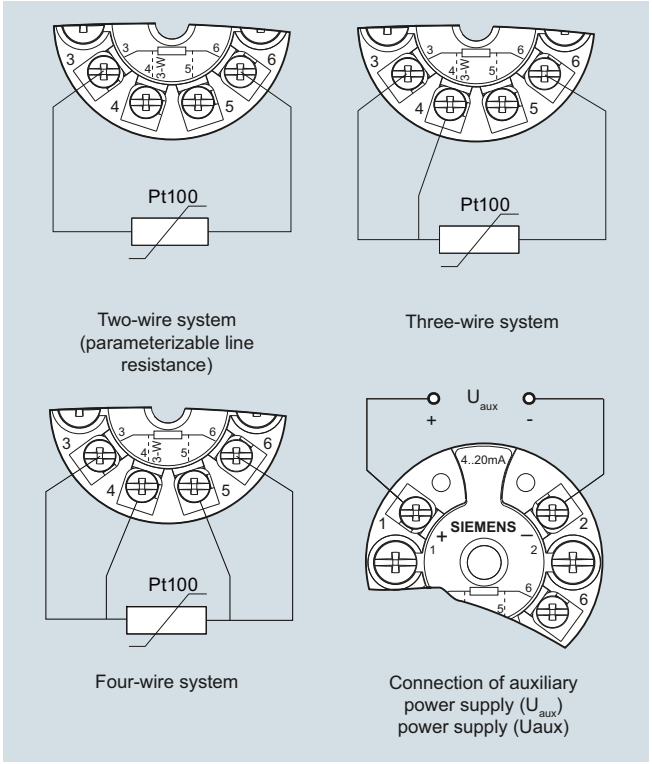


SITRANS TH100, mounting of transmitter on DIN rail



DIN rail adaptor, dimensions in mm (inch)

Schematics



SITRANS TH100, sensor connection assignment

SITRANS TH200 two-wire system, universal

Overview

Ultra flexible - with the universal SITRANS TH200 transmitter

- Two-wire devices for 4 to 20 mA
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits

- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- SIL2 (with Order Code C20), SIL2/3 (with C23)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TH200 transmitters can be used in all industrial sectors. Due to their compact size they can be installed in the connection head type B (DIN 43729) or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (2, 3 or 4-wire system)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic.

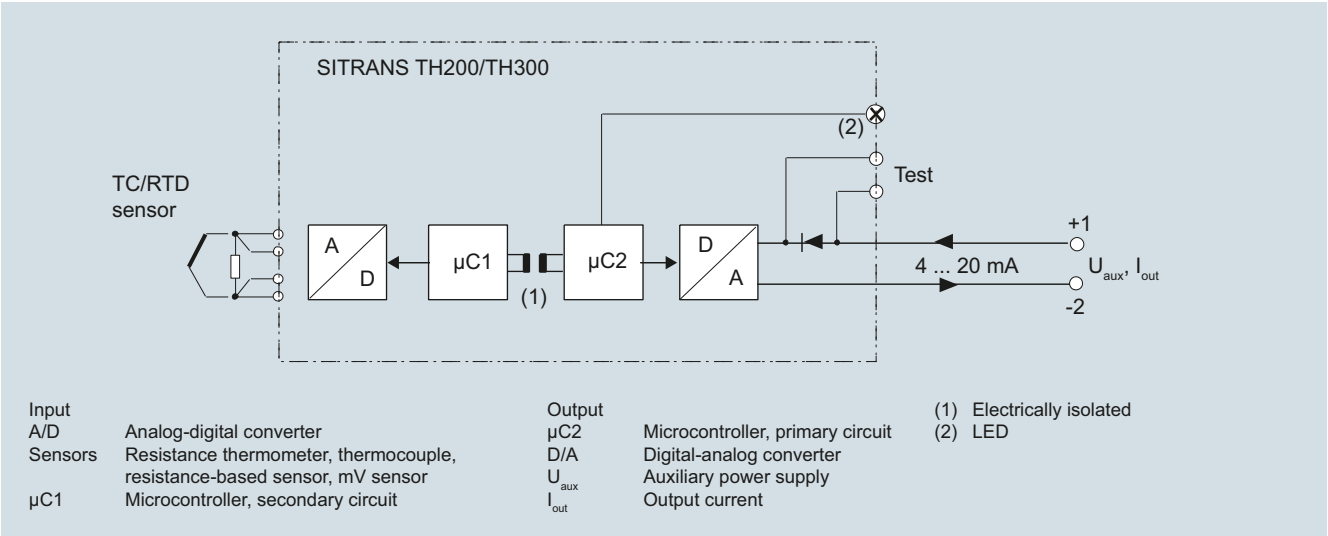
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function

The SITRANS TH200 is configured over a PC. A USB or RS 232 modem is linked to the output terminals for this purpose. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



SITRANS TH200 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• To JIS C 1604; a = 0.00392 K^{-1}	Pt25 … Pt1000
• to IEC 60751	Ni25 … Ni1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 identical resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensors	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Normal connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance-based sensors in 2-wire system for generation of average value
• Generation of difference	2 resistance thermometers in 2-wire system (R1 – R2 or R2 – R1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 Ω ... 25 Ω (see Table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. to ASTM 988
• Type E	NiCr-CuNi to DIN IEC 584
• Type J	Fe-CuNi to DIN IEC 584
• Type K	NiCr-Ni to DIN IEC 584
• Type L	Fe-CuNi to DIN 43710
• Type N	NiCrSi-NiSi to DIN IEC 584
• Type R	Pt13Rh-Pt to DIN IEC 584
• Type S	Pt10Rh-Pt to DIN IEC 584
• Type T	Cu-CuNi to DIN IEC 584
• Type U	Cu-CuNi to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Generation of average value	2 thermocouples (TC)
• Generation of difference	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	Parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Measuring range	-10 ... +70 mV-100 … +1100 mV

SITRANS TH200 two-wire system, universal

Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic
Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	11 ... 35 V DC ((to 30 V for Ex ia and ib; to 32 V for Ex nA / nL / ic)
Max. load	$(U_{aux} - 11\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.80 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reversed polarity
Electrically isolated	Input against output (1 kV_{eff})
Measuring accuracy	
Digital measuring errors	See table "Digital measuring errors"
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10°C (18 °F)
• Digital measuring errors	
- with resistance thermometers	0.06 °C (0.11 °F)/10°C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10°C (18 °F)
Auxiliary power effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• In the first month	• < 0.02 % of span
• After one year	• < 0.2 % of span
• After 5 years	• < 0.3 % of span
Conditions of use	
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	acc. to EN 61326 and NE21
Construction	
Material	Molded plastic
Weight	50 g (0.11 lb)
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm² (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP40
• Terminals	IP00

Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 05 ATEX 2040X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T6/T4 II 2 (1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 1D Ex iaD 20 T115 °C
• "Operating equipment that is non-ignitable and has limited energy" type of protection	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degree of protection	IS / Cl I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 Cl I / ZN 0 / AEx ia IIC T6, T5, T4 NI / Cl I / Div 2 / GP ABCDFG T6, T5, T4 NI / Cl I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degree of protection	IS / Cl I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / Cl I / DIV 2 / GP ABCD T6, T5, T4 NIFW / Cl I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / Cl II, III / Div 2 / GP FG T6, T5, T4 Cl I / ZN 0 / Ex ia IIC T6, T5, T4 Cl I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	GOST, NEPSI, PESO, IEC, EXPOLABS
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; can also be used in connection with RS 232 modem under Windows 95, 98 and 98SE

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
Pt50	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +649 (-328 ... +1200)	10	(18)	0.1	(0.18)
Pt500	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
Ni 25 ... Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

Resistance-based sensors

Input	Measuring range	Min. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0,05
Resistance	0 ... 2200	25	0,25

Thermocouples

Input	Measuring range		Min. measured span		Digital accuracy
	°C/(°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1]	(3.60)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.60)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.80)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.80)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.80)
Type K	-230 ... +1370 (-382 ... +2498)	50	(90)	1	(1.80)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.80)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.80)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.80)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.60)

[1] The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

[2] The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring range	Min. measured span	Digital accuracy
	mV	mV	µV
mV sensor	-10 ... +70	2	40
mV sensor	-100 ... +1100	20	400

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.025 % of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

SITRANS TH200 two-wire system, universal

Selection and Ordering data	Article No.
Temperature transmitter SITRANS TH200	
for installation in connection head, type B (DIN 43729), two-wire system, 4 ... 20 mA, programmable, with electrical isolation	
• Without explosion protection	**7NG3211-1NN00**
• With explosion protection	
- to ATEX	**7NG3211-1AN00**
- to FM ($_cFM_{US}$)	**7NG3211-1BN00**
Further designs	Order code
Add "**-Z**" to Article No. and specify Order code(s)	
With test protocol (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point no. (TAG), max. 8 characters	**Y17**[2]
Measuring point descriptor, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Thermocouple type B	**U20**[3][4]
Thermocouple type C (W5)	**U21**[3][4]
Thermocouple type D (W3)	**U22**[3][4]
Thermocouple type E	**U23**[3][4]
Thermocouple type J	**U24**[3][4]
Thermocouple type K	**U25**[3][4]
Thermocouple type L	**U26**[3][4]
Thermocouple type N	**U27**[3][4]
Thermocouple type R	**U28**[3][4]
Thermocouple type S	**U29**[3][4]
Thermocouple type T	**U30**[3][4]
Thermocouple type U	**U31**[3][4]
With TC: CJC external (Pt100, 3-wire)	**U41**
With TC: CJC external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[5]
Fail-safe value 3.6 mA (instead of 22,8 mA)	**U36**[2]
Cable extension Transmitter with installed cable extension 200 mm (7.81 inch), for Pt100 in four-wire system	**W01**

Accessories	Article No.
Modem for SITRANS TH100, TH200, TR200 and TF with TH200 incl. SIPROM T parameterization software With USB connection	**7NG3092-8KU**
MiniDVD for temperature measuring instruments With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	**A5E00364512**
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	**7NG3092-8KA**
Connecting cable 4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	**7NG3092-8KC**

1) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
2) For this selection, Y01 or Y09 must also be selected.
3) For this selection, Y01 must also be selected.
4) Internal cold junction compensation is selected as the default for TC.
5) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Supply units see Chapter "Supplementary Components".

Ordering example 1:

7NG3211-1NN00-Z Y01+Y17+U03
Y01: -10 ... +100 °C
Y17: TICA123

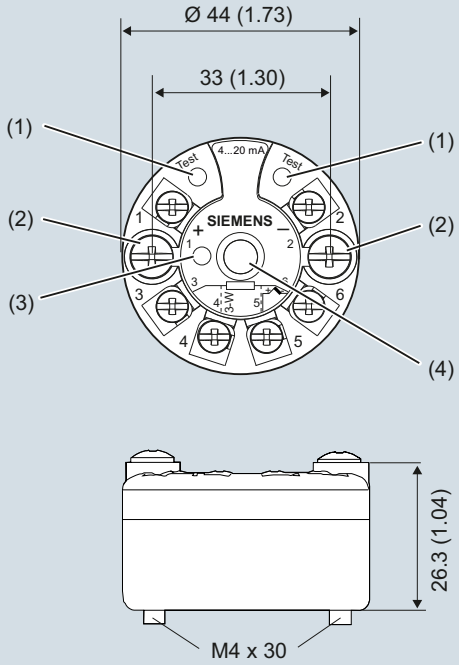
Ordering example 2:

7NG3211-1NN00-Z Y01+Y23+U25
Y01: -10 ... +100 °C
Y23: TICA1234HEAT

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 … 100 °C (32 … 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

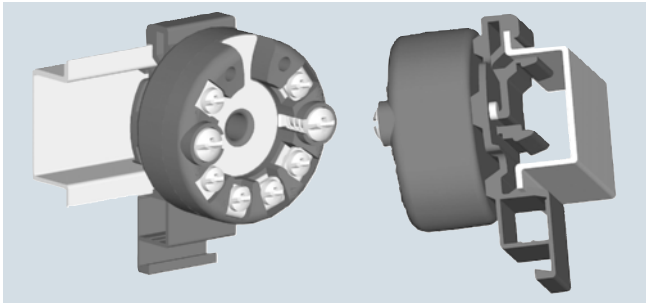
Dimensional drawings



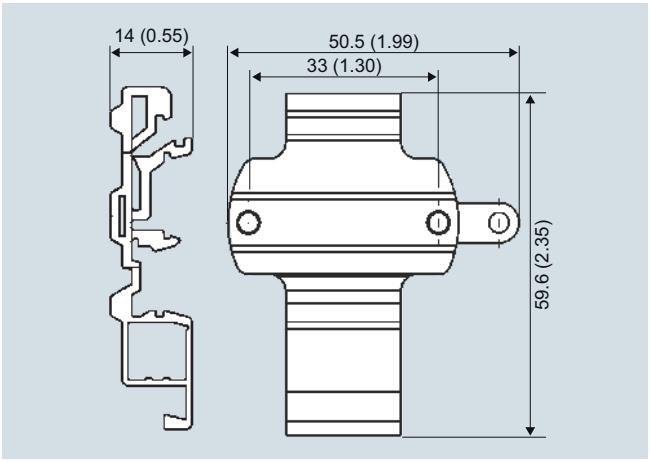
1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see Sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x30
(3)	LED for operation indication
(4)	Internal diameter of center hole 6.3 (0.25)

SITRANS TH200, dimensions and pin assignment, dimensions in mm (inch)

Mounting on DIN rail



SITRANS TH200, mounting of transmitter on DIN rail

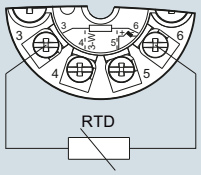


DIN rail adapter, dimensions in mm (inch)

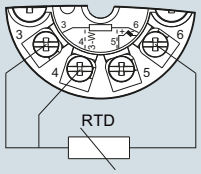
2

Schematics

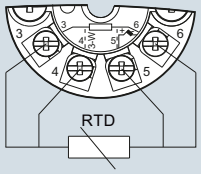
Resistance thermometer



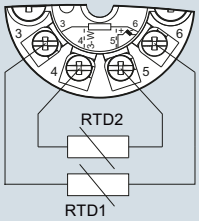
Two-wire system [1)]



Three-wire system

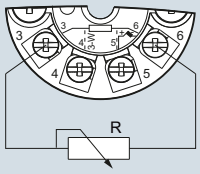


Four-wire system

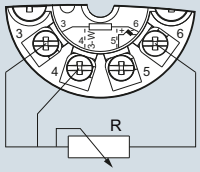


Generation of average value / difference [1)]

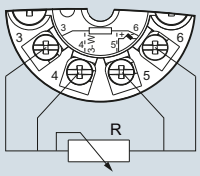
Resistance



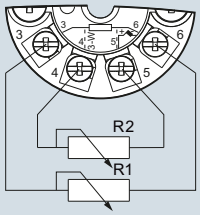
Two-wire system [1)]



Three-wire system

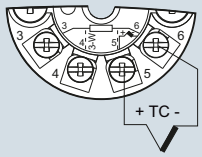


Four-wire system

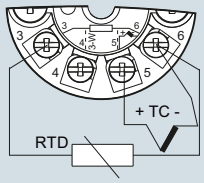


Generation of average value / difference [1)]

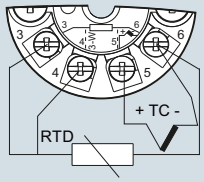
Thermocouple



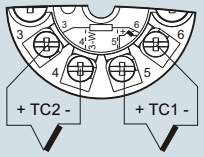
Cold junction compensation
Internal/fixed value



Cold junction compensation with external Pt100 in two-wire system [1)]



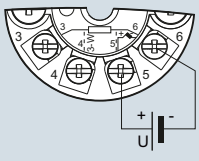
Cold junction compensation with external Pt100 in three-wire system



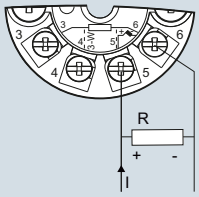
Generation of average value / difference with internal cold junction compensation

[1)] Programmable line resistance for the purpose of correction.

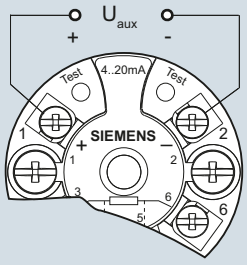
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH200, sensor connection assignment

Overview

"HART" to beat - the universal SITRANS TH300 transmitter

- Two-wire devices for 4 to 20 mA, HART
- Mounting in the connection head of the temperature sensor
- Universal input for virtually any type of temperature sensor
- Configurable over HART

Benefits

- Compact design
- Flexible mounting and center hole allow you to select your preferred type of installation
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- SIL2 (with Order Code C20), SIL2/3 (with C23)
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21

Application

SITRANS TH300 transmitters can be used in all industrial sectors. Due to their compact size they can be installed in the connection head type B (DIN 43729) or larger. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (2, 3 or 4-wire system)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic, superimposed by the digital HART signal.

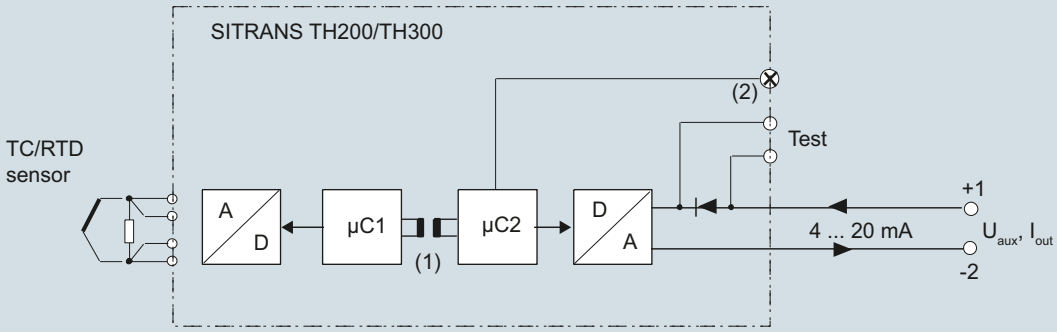
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Function

The SITRANS TH300 is configured over HART. This can be done using a handheld communicator or even more conveniently with a HART modem and the SIMATIC PDM parameterization software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



Input		Output			
A/D	Analog-digital converter	µC2	Microcontroller, primary circuit	(1)	Electrically isolated
Sensors	Resistance thermometer, thermocouple, resistance-based sensor, mV sensor	D/A	Digital-analog converter	(2)	LED
		U_{aux}	Auxiliary power supply		
µC1	Microcontroller, secondary circuit	I_{out}	Output current		

SITRANS TH 300 function diagram

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Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• To JIS C 1604; a = 0.00392 K^{-1}	Pt25 … Pt1000
• to IEC 60751	Ni25 … Ni1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 identical resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensors	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Normal connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance-based sensors in 2-wire system for generation of average value
• Generation of difference	2 resistance thermometers in 2-wire system (R1 – R2 or R2 – R1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. to ASTM 988
• Type E	NiCr-CuNi to DIN IEC 584
• Type J	Fe-CuNi to DIN IEC 584
• Type K	NiCr-Ni to DIN IEC 584
• Type L	Fe-CuNi to DIN 43710
• Type N	NiCrSi-NiSi to DIN IEC 584
• Type R	Pt13Rh-Pt to DIN IEC 584
• Type S	Pt10Rh-Pt to DIN IEC 584
• Type T	Cu-CuNi to DIN IEC 584
• Type U	Cu-CuNi to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Generation of average value	2 thermocouples (TC)
• Generation of difference	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring

Open-circuit monitoring	Can be switched off
Measuring range	-10 ... +70 mV -100 … +1100 mV
Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic
Output	
Output signal	4 ... 20 mA, 2-wire with communication acc. to HART Rev. 5.9
Auxiliary power	11 ... 35 V DC (to 30 V for Ex ia and ib; to 32 V for Ex nA/nL/ic)
Max. load	(U_{aux} –11 V)/0.023 A
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.80 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reversed polarity
Electrically isolated	Input against output (1 kV_{eff})
Measuring accuracy	
Digital measuring errors	See Table "Digital measuring errors"
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10°C (18 °F)
• Digital measuring errors	
- with resistance thermometers	0.06 °C (0.11 °F)/10°C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10°C (18 °F)
Auxiliary power effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of span
• After one year	< 0.2 % of span
• After 5 years	< 0.3 % of span
Conditions of use	
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	acc. to EN 61326 and NE21

Construction	
Material	Molded plastic
Weight	50 g (0.11 lb)
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP40
• Terminals	IP00
Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 05 ATEX 2040X
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T6/T4 II 2 (1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 1D Ex iaD 20 T115 °C
• "Operating equipment that is non-ignitable and has limited energy" type of protection	II 3 G Ex nL IIC T6/T4 II 3 G Ex nA IIC T6/T4
Explosion protection: FM for USA	
• FM approval	FM 3024169
• Degree of protection	IS / Cl I, II, III / Div 1 / GP ABCDEFG T6, T5, T4 Cl I / ZN 0 / AEx ia IIC T6, T5, T4 NI / Cl I / Div 2 / GP ABCDFG T6, T5, T4 NI / Cl I / ZN 2 / IIC T6, T5, T4
Explosion protection to FM for Canada ($_cFM_{US}$)	
• FM approval	FM 3024169C
• Degree of protection	IS / Cl I, II, III / Div 1/ GP ABCDEFG T6, T5, T4 NI / Cl I / DIV 2 / GP ABCD T6, T5, T4 NIFW / Cl I, II, III / DIV 2 / GP ABCDFG T6, T5, T4 DIP / Cl II, III / Div 2 / GP FG T6, T5, T4 Cl I / ZN 0 / Ex ia IIC T6, T5, T4 Cl I / ZN 2 / Ex nA nL IIC T6, T5, T4
Other certificates	GOST, NEPSI, PESO, IEC, EXPOLABS

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
Pt50	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +649 (-328 ... +1200)	10	(18)	0.1	(0.18)
Pt500	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
Ni 25 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

Resistance-based sensors

Input	Measuring range	Min. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0,05
Resistance	0 ... 2200	25	0,25

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1]	(3.60)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.60)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.80)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.80)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.80)
Type K	-230 ... +1370 (-382 ... +2498)	50	(90)	1	(1.80)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.80)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.80)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.60)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.80)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.60)

[1] The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

[2] The digital accuracy in the range 1750 to 2300 (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring range	Min. measured span	Digital accuracy
	mV	mV	µV
mV sensor	-10 ... +70	2	40
mV sensor	-100 ... +1100	20	400

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.025 % of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

Selection and Ordering data	Article No.
Temperature transmitter SITRANS TH300	
for installation in connection head, type B (DIN 43729), two-wire system 4 ... 20 mA, communication capable to HART, with galvanic isolation	
• Without explosion protection	**7NG3212-0NN00**
• With explosion protection	
- to ATEX	**7NG3212-0AN00**
- to FM ($_{C}FM_{US}$)	**7NG3212-0BN00**
Further designs	Order code
Add "**-Z**" to Article No. and specify Order code(s)	
with test protocol (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point no. (TAG), max. 8 characters	**Y17**[2]
Measuring point descriptor, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Thermocouple type B	**U20**[3][4]
Thermocouple type C (W5)	**U21**[3][4]
Thermocouple type D (W3)	**U22**[3][4]
Thermocouple type E	**U23**[3][4]
Thermocouple type J	**U24**[3][4]
Thermocouple type K	**U25**[3][4]
Thermocouple type L	**U26**[3][4]
Thermocouple type N	**U27**[3][4]
Thermocouple type R	**U28**[3][4]
Thermocouple type S	**U29**[3][4]
Thermocouple type T	**U30**[3][4]
Thermocouple type U	**U31**[3][4]
With TC: CJC external (Pt100, 3-wire)	**U41**
With TC: CJC external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[5]
Fail-safe value 3.6 mA (instead of 22,8 mA)	**U36**[2]
Cable extension Transmitter with installed cable extension 200 mm (7.87 inch), for Pt100 in four-wire system	**W01**

Accessories	Article No.
MiniDVD for temperature measuring instruments With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	**A5E00364512**
HART modem	
• With USB connection	**7MF4997-1DB**
SIMATIC PDM operating software	**See Section 8**
DIN rail adapters for head transmitters (Quantity delivered: 5 units)	**7NG3092-8KA**
Connecting cable 4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	**7NG3092-8KC**

[1] For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

[2] For this selection, Y01 or Y09 must also be selected.

[3] For this selection, Y01 must also be selected.

[4] Internal cold junction compensation is selected as the default for TC.

[5] For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Supply units see Chapter "Supplementary Components".

Ordering example 1:

7NG3212-0NN00-Z Y01+Y17+U03
Y01: -10 ... +100 °C
Y17: TICA123

Ordering example 2:

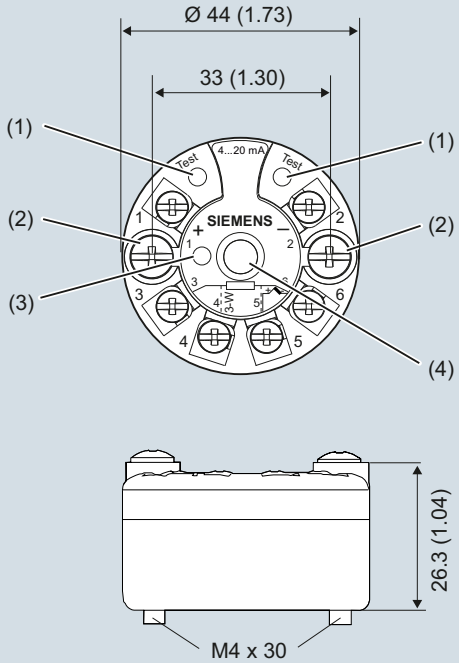
7NG3212-0NN00-Z Y01+Y23+U25
Y01: -10 ... +100 °C
Y23: TICA1234HEAT

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

2

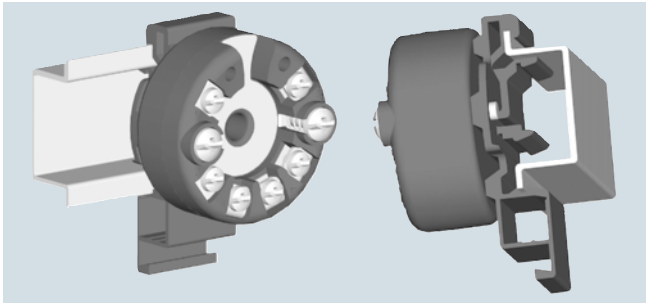
Dimensional drawings



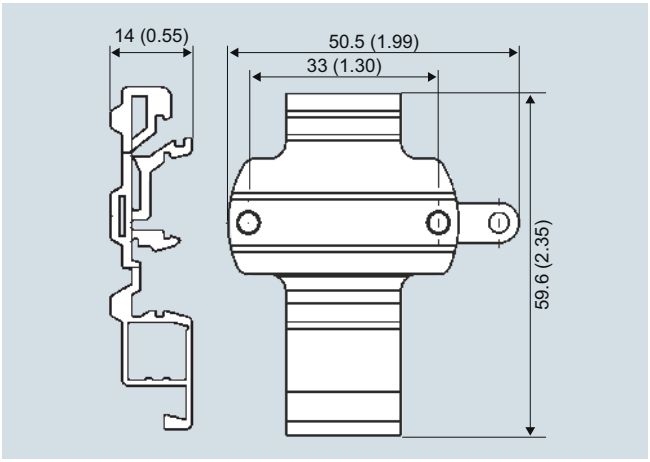
1(+) and 2(-)	Auxiliary power supply U_{aux}, output current I_{Out}
3, 4, 5 and 6	Pt100 sensor (for connections, see Sensor connection assignment)
Test (+), Test (-)	Measurement of the output current with a multimeter
(1)	Test terminal
(2)	Mounting screw M4x30
(3)	LED for operation indication
(4)	Internal diameter of center hole 6.3 (0.25)

SITRANS TH300, dimensions and pin assignment, dimensions in mm (inch)

Mounting on DIN rail



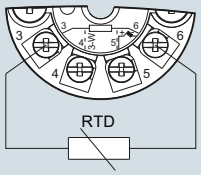
SITRANS TH300, mounting of transmitter on DIN rail



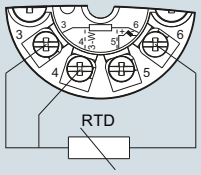
DIN rail adapter, dimensions in mm (inch)

Schematics

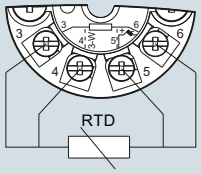
Resistance thermometer



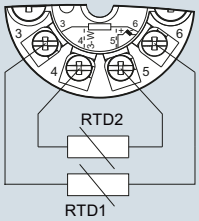
Two-wire system [1)]



Three-wire system

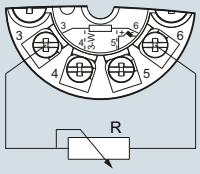


Four-wire system

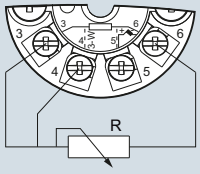


Generation of average value / difference [1)]

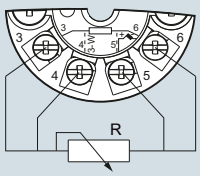
Resistance



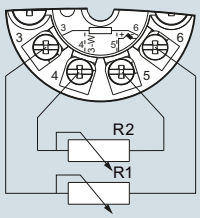
Two-wire system [1)]



Three-wire system

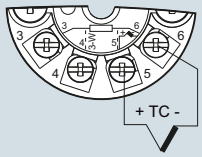


Four-wire system

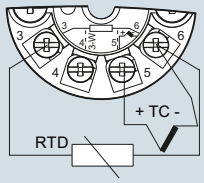


Generation of average value / difference [1)]

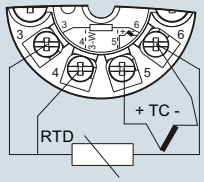
Thermocouple



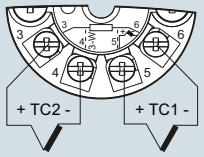
Cold junction compensation
Internal/fixed value



Cold junction compensation with external Pt100 in two-wire system [1)]



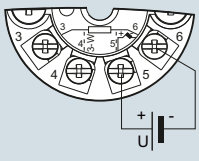
Cold junction compensation with external Pt100 in three-wire system



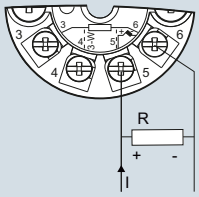
Generation of average value / difference with internal cold junction compensation

[1)] Programmable line resistance for the purpose of correction.

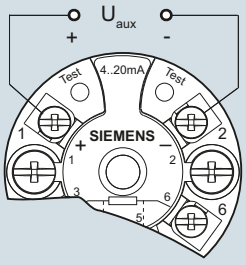
Voltage measurement



Current measurement



Connection of auxiliary power supply (U_{aux})



SITRANS TH300, sensor connection assignment

SITRANS TH400 fieldbus transmitter

Overview

SITRANS TH400 fieldbus transmitters

Versions:

- For FOUNDATION fieldbus
- For PROFIBUS PA

The SITRANS TH400 temperature transmitter is a small field bus transmitter for mounting in the connection head of form B. Extensive functionality enables the temperature transmitter to be precisely adapted to the plant's requirements. Operation is very simple in spite of the numerous setting options. Thanks to its universal concept it can be used in all industries and is easy to integrate in the context of Totally Integrated Automation applications.

Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX), as well as FM and CSA regulations.

Installing SITRANS TH400 in temperature sensors turns them into complete, bus-capable measuring points; compact - and in a single device.

Application

- Linearized temperature measurement with resistance thermometers or thermal elements
- Differential, mean-value or redundant temperature measurement with resistance thermometers or thermal elements
- Linear resistance and bipolar millivolt measurements
- Differential, mean-value or redundant resistance and bipolar millivolt measurements

Function

Features

- Mounting in connection head, type B, to DIN 43729, or larger
- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Electrically isolated
- Intrinsically-safe version for use in potentially explosive areas
- Special characteristic
- Sensor redundance

With PROFIBUS PA communication

- Function blocks: 2 x analog

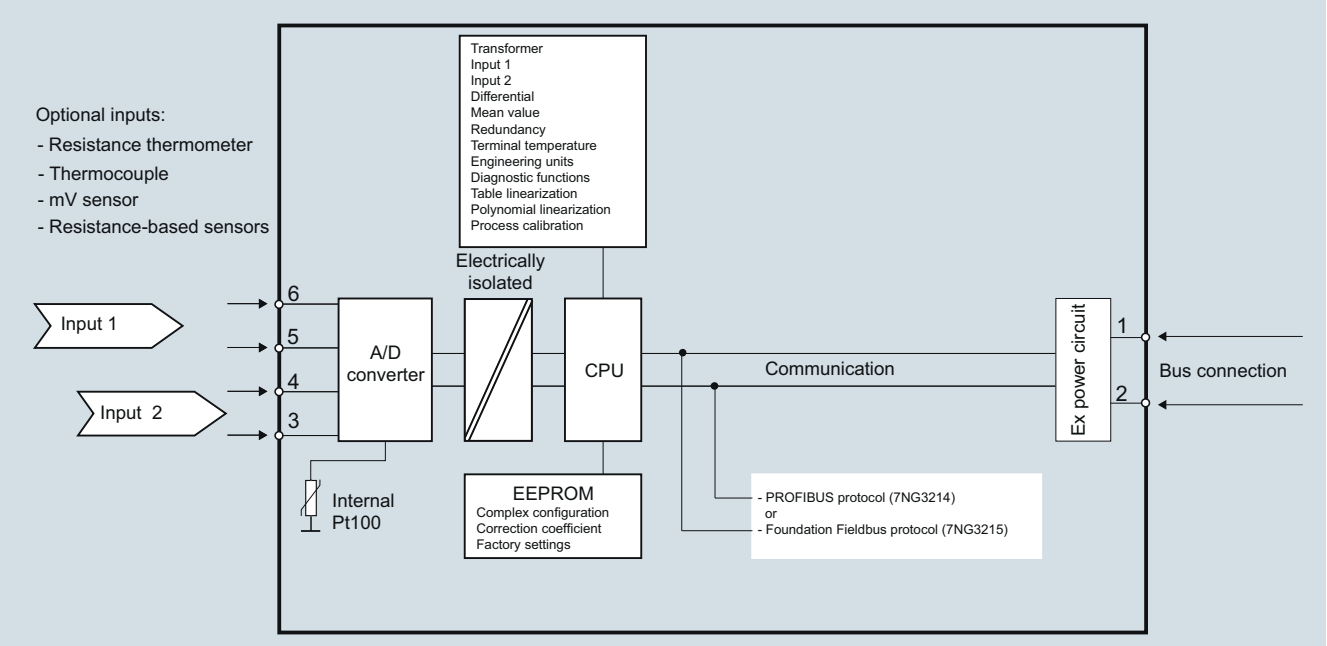
With FOUNDATION fieldbus communication

- Function blocks: 2 x analog and 1 x PID
- Functionality: Basic or LAS

Mode of operation

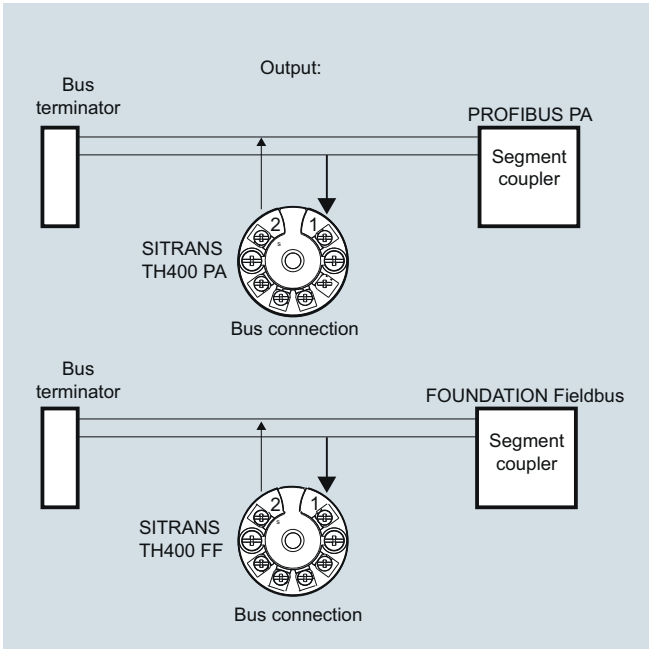
The following function diagram explains the mode of operation of the transmitter.

The only difference between the two versions of the SITRANS TH400 (7NG3214-... and 7NG3215-...) is the type of fieldbus protocol used (PROFIBUS PA or FOUNDATION fieldbus).



SITRANS TH400, function diagram

System communication



SITRANS TH400, communication interface

Technical specifications

Input	
Analog-to-digital conversion	
• Measurement rate	< 50 ms
• Resolution	24-bit
Resistance thermometer	
Pt25 ... Pt1000 to IEC 60751/JIS C 1604	
• Measuring range	-200 ... +850 °C (-328 ... +1562 °F)
Ni25 ... Ni1000 to DIN 43760	
• Measuring range	-60 ... +250 °C (-76 ... +482 °F)
Cu10 ... Cu1000, α = 0.00427	
• Measuring range	-50 ... +200 °C (-58 ... +392 °F)
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Resistance-based sensors	
Measuring range	0 Ω ... 10 kΩ
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Thermocouple	
to IEC 584	Measuring range
• Type B	400 .. +1820 °C (752 ... 3308 °F)
• Type E	-100 ... +1000 °C (-148 ... +1832 °F)
• Type J	-100 ... +1000 °C (-148 ... +1832 °F)
• Type K	-100 ... +1200 °C (-148 ... +2192 °F)
• Type N	-180 ... +1300 °C (-292 ... +2372 °F)
• Type R	-50 ... +1760 °C (-58 ... +3200 °F)
• Type S	-50 ... +1760 °C (-58 ... +3200 °F)
• Type T	-200 ... +400 °C (-328 ... +752 °F)
to DIN 43710	
• Type L	-200 ... +900 °C (-328 ... +1652 °F)
• Type U	-200 ... +600 °C (-328 ... +1112 °F)
to ASTM E988-90	
• Type W3	0 ... 2300 °C (32 ... +4172 °F)
• Type W5	0 ... 2300 °C (32 ... +4172 °F)
External cold junction compensation	-40 ... +135 °C (-40 ... +275 °F)
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 3 mV
• Sensor current in the event of open-circuit monitoring	4 μA
mV sensor - voltage input	
Measuring range	-800 ... +800 mV
Input resistance	10 MΩ
Output	
Filter time (programmable)	0 ... 60 s
Update time	< 400 ms
Measuring accuracy	
Accuracy is defined as the higher value of general values and basic values.	

General values

Type of input	Absolute accuracy	Temperature coefficient
All	≤ ± 0.05 % of the measured value	≤ ± 0.002 % of the measured value/°C

Basic values

Type of input	Basic accuracy	Temperature coefficient
Pt100 and Pt1000	≤ ± 0.1 °C	≤ ± 0.002 °C/°C
Ni100	≤ ± 0.15 °C	≤ ± 0.002 °C/°C
Cu10	≤ ± 1.3 °C	≤ ± 0.02 °C/°C
Resistance-based sensors	≤ ± 0.05 Ω	≤ ± 0.002 Ω/°C
Voltage source	≤ ± 10 μV	≤ ± 0.2 % μV/°C
Thermocouple, type: E, J, K, L, N, T, U	≤ ± 0.5 °C	≤ ± 0.01 °C/°C
Thermocouple, type: B, R, S, W3, W5	≤ ± 1 °C	≤ ± 0.025 °C/°C
Cold junction compensation	≤ ± 0.5 °C	

Reference conditions	
Warming-up time	30 s
Signal-to-noise ratio	Min. 60 dB
Calibration condition	20 ... 28 °C (68 ... 82 °F)

SITRANS TH400 fieldbus transmitter

Conditions of use	
Ambient conditions	
Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation
Insulation resistance	
• Test voltage	500 V AC for 60 s
Mechanical testing	
• Vibrations (DIN class B) to	IEC 60068-2-6 and IEC 60068-2-64 4 g/2 ... 100 Hz
Electromagnetic compatibility	
EMC noise voltage influence	< ± 0.1 % of span
Extended EMC noise immunity: NAMUR NE 21, criterion A, Burst	< ± 1 % of span
EMC 2004/108/EC Emission and Noise Immunity to	EN 61326
Construction	
Material	Molded plastic
Weight	55 g (0.12 lb)
Dimensions	See Dimensional drawings
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection	
• Transmitter enclosure	IP40
• Terminal	IP00
Auxiliary power	
Power supply	
• Standard, Ex "nA", Ex "nL", NI	9.0 ... 32 V DC
• ATEX, FM, UL and CSA	9.0 ... 30 V DC
• In FISCO/FNICO installations	9.0 ... 17.5 V DC
Power consumption	< 11 mA
Max. increase in power consumption in the event of a fault	< 7 mA

Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	KEMA 06 ATEX 0264
• "Intrinsic safety" type of protection	II 1 G Ex ia IIC T4...T6 II 2(1) G Ex ib[ia] IIC T4...T6 II 1 D Ex iaD
EC type test certificate	KEMA 06 ATEX 0263 X
• Type of protection for "equipment is non-arcing"	II 3 GD Ex nA[nL] IIC T4...T6 II 3 GD Ex nL IIC T4...T6 II 3 GD Ex nA[ic] IIC T4...T6 II 3 GD Ex ic IIC T4...T6
Explosion protection: FM for USA	
• FM approval	FM 3027985
• Degree of protection	• IS Class I, Div 1, Groups A, B, C, D T4/T5/T6, FISCO • IS Class I, Zone 0, AEx ia, IIC T4/T5/T6, FISCO • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6, FNICO
Explosion protection CSA for Canada	
• CSA approval	CSA 1861385
• Degree of protection	• IS Class I, Div 1, Groups A, B, C, D T4/T5/T6 • Ex ia IIC T4/T5/T6 and Ex ib [ia] IIC T4/T5/T6 • NI Class I, Div 2, Groups A, B, C, D T4/T5/T6 • Ex nA II T4/T5/T6
Other certificates	GOST, PESO
Communication	
Parameterization interface	
• PROFIBUS PA connection	
- Protocol	Profile 3.0
- Address (for delivery)	126
• FOUNDATION fieldbus connection	
- Protocol	FF protocol
- Functionality	Basic or LAS
- Version	ITK 4.6
- Function blocks	2 x analog and 1 x PID
Factory setting	
only for SITRANS TH400 PA	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
PA address	126
PROFIBUS Ident No.	Manufacturer-specific
only for SITRANS TH400 FF	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Selection and Ordering data	Article No.
Temperature transmitter SITRANS TH400	
for installation in connection head, with electrical isolation, order operating instructions separately.	
• Bus-compatible to PROFIBUS PA	
- No explosion protection or Zone 2/Div 2 to ATEX/FM/CSA/IECEX/NEPSI	**7NG3214-0NN00**
- With explosion protection "Intrinsically safe to ATEX/FM/CSA/IECEX/NEPSI"	**7NG3214-0AN00**
• Bus-compatible to FOUNDATION Fieldbus	
- No explosion protection or Zone 2/Div 2 to ATEX/FM/CSA/IECEX/NEPSI	**7NG3215-0NN00**
- With explosion protection "Intrinsically safe to ATEX/FM/CSA/IECEX/NEPSI"	**7NG3215-0AN00**
Further designs	Order code
Please add "**-Z**" to Article No. and specify Order code(s) and plain text.	
With test protocol (5 measuring points)	**C11**
Customer-specific programming	
Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point no. (TAG), max. 32 characters	**Y17**[2]
Measuring point descriptor, max. 32 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Bus address, specify in plain text	**Y25**[2]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[3]
Pt100 (IEC) 3-wire	**U03**[3]
Pt100 (IEC) 4-wire	**U04**[3]
Thermocouple type B	**U20**[3)4]
Thermocouple type C (W5)	**U21**[3)4]
Thermocouple type D (W3)	**U22**[3)4]
Thermocouple type E	**U23**[3)4]
Thermocouple type J	**U24**[3)4]
Thermocouple type K	**U25**[3)4]
Thermocouple type L	**U26**[3)4]
Thermocouple type N	**U27**[3)4]
Thermocouple type R	**U28**[3)4]
Thermocouple type S	**U29**[3)4]
Thermocouple type T	**U30**[3)4]
Thermocouple type U	**U31**[3)4]
With TC: CJC external (Pt100, 3-wire)	**U41**
With TC: CJC external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[5]

Accessories	Article No.
MiniDVD for temperature measuring instruments	**A5E00364512**
With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	
SIMATIC PDM operating software	**See Chapter 8**
DIN rail adapters for head transmitters	**7NG3092-8KA**
(Quantity delivered: 5 units)	
Connecting cable	**7NG3092-8KC**
4-wire, 150 mm, for sensor connections when using head transmitters in the high hinged cover (set with 5 units)	
for additional PA components	**See Catalog IK PI**

1) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

2) For this selection, Y01 or Y09 must also be selected.

3) For this selection, Y01 must also be selected.

4) Internal cold junction compensation is selected as the default for TC.

5) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Ordering example 1:

7NG3214-0NN00-Z Y01+Y17+U03
Y01: 0...100 °C
Y17: TICA1234HEAT

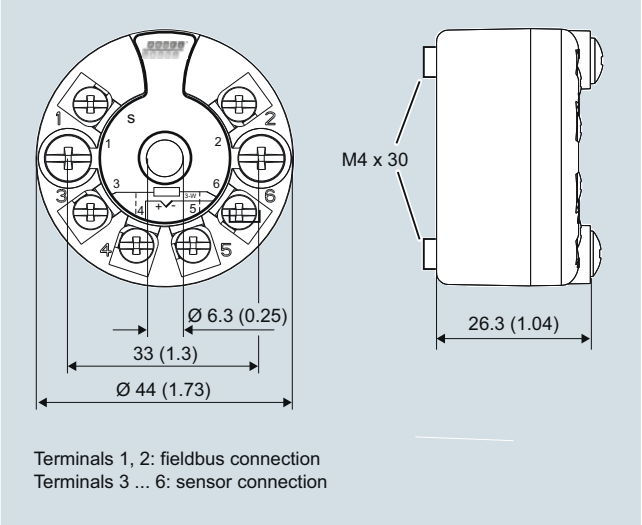
Ordering example 2:

7NG3214-0NN00-Z Y01+Y17+Y25+U25
Y01: 0...500 °C
Y17: TICA5678HEAT
Y25: 33

Factory setting:

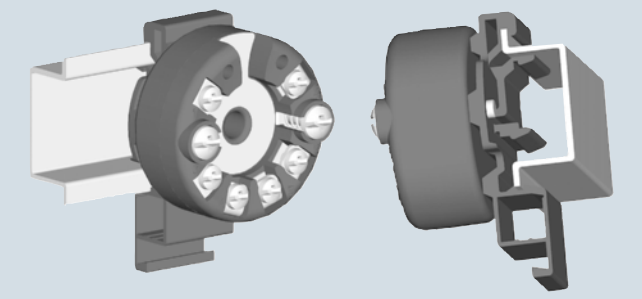
- For SITRANS TH400 PA:
  - Pt100 (IEC 751) with 3-wire circuit
  - Unit: °C
  - Failure mode: Last valid value
  - Filter time: 0 s
  - PA address: 126
  - PROFIBUS Ident No.: Manufacturer-specific
- For SITRANS TH400 FF:
  - Pt100 (IEC 751) with 3-wire circuit
  - Unit: °C
  - Failure mode: Last valid value
  - Filter time: 0 s
  - Node address: 22

Dimensional drawings

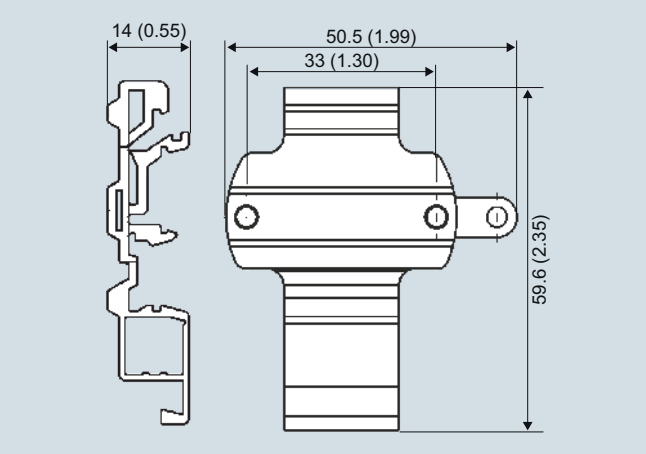


SITRANS TH400 dimensions in mm (inches) and connections

Mounting on DIN rail



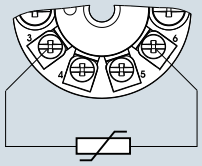
SITRANS TH400, mounting of transmitter on DIN rail



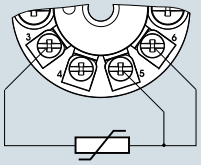
DIN rail adaptor, dimensions in mm (inch)

Schematics

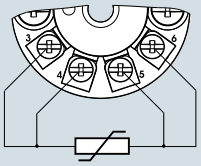
Resistance thermometer



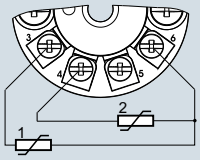
Two-wire system [1)]



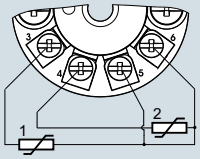
Three-wire system



Four-wire system

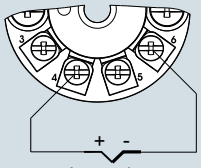


Mean-value/differential or redundancy generation
2 x two-wire system [1)]

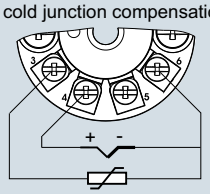


Mean-value/differential or redundancy generation
1 sensor in two-wire system [1)]
1 sensor in three-wire system

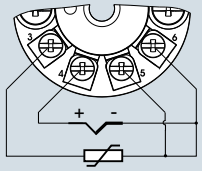
Thermocouple



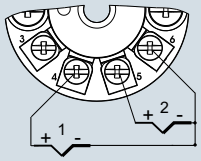
Internal
cold junction compensation



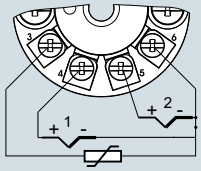
Cold junction compensation
with external Pt100 in two-wire system [1)]



Cold junction compensation
with external Pt100 in three-wire system

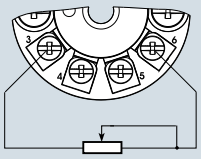


Mean value, differential or redundancy generation with internal cold junction compensation

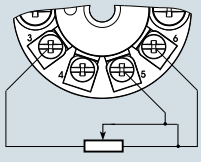


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100 in two-wire system [1)]

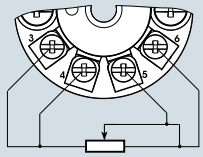
Resistance



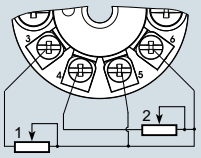
Two-wire system [1)]



Three-wire system

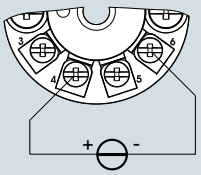


Four-wire system

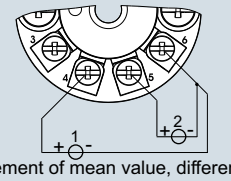


Mean value, differential or redundancy generation
1 resistor in two-wire system [1)]
1 resistor in three-wire system

Voltage measurement



One voltage source



Measurement of mean value, differential and redundancy with 2 voltage sources

[1)] Programmable line resistance for the purpose of correction.

SITRANS TH400, sensor connection assignment

SITRANS TR200 two-wire system, universal

2

Overview

Ultra flexible - with the universal SITRANS TR200 transmitter

- Two-wire devices for 4 to 20 mA
- Enclosure for rail mounting
- Universal input for virtually any type of temperature sensor
- Configurable over PC

Benefits

- Compact design
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21
- SIL2 (with Order Code C20), SIL2/3 (with C23)

Application

SITRANS TR200 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (2, 3 or 4-wire system)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic.

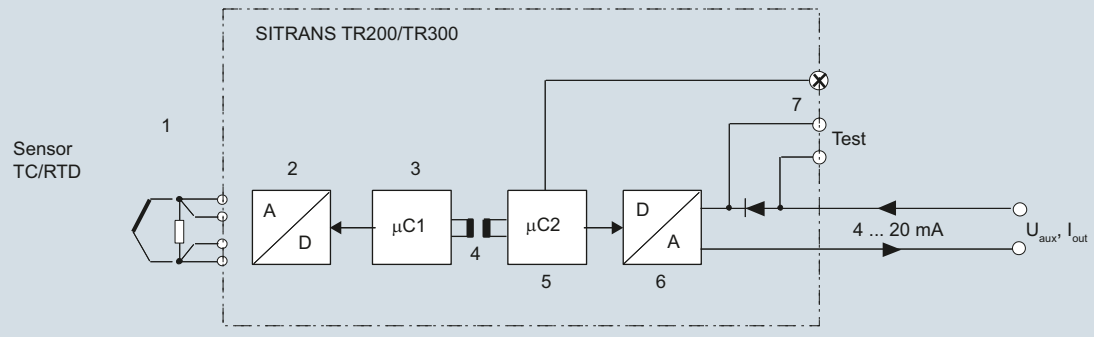
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

Function

The SITRANS TR200 is configured over a PC. A USB or RS 232 modem is linked to the output terminals for this purpose. The configuration data can now be edited using the SIPROM T software tool. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



1 Sensor such as resistance thermometer, thermocouple, resistance-based, sensor, mV sensor
2 Analog-digital converter
3 Microcontroller, secondary circuit
4 Electrical isolation
5 Microcontroller, primary circuit
6 Digital-analog converter
7 LED

U_{aux} Auxiliary power supply
I_{out} Output current
Test Test terminals for temporary connection of an amperemeter

SITRANS TR200 function diagram

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … 1000
• to JIS C 1604; a=0.00392 K^{-1}	Pt25 … 1000
• to IEC 60751	Ni25 … 1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensors	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Normal connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance-based sensors in 2-wire system for generation of average value
• Generation of difference	2 resistance thermometers in 2-wire system (R1 – R2 or R2 – R1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. to ASTM 988
• Type E	NiCr-CuNi to DIN IEC 584
• Type J	Fe-CuNi to DIN IEC 584
• Type K	NiCr-Ni to DIN IEC 584
• Type L	Fe-CuNi to DIN 43710
• Type N	NiCrSi-NiSi to DIN IEC 584
• Type R	Pt13Rh-Pt to DIN IEC 584
• Type S	Pt10Rh-Pt to DIN IEC 584
• Type T	Cu-CuNi to DIN IEC 584
• Type U	Cu-CuNi to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Generation of average value	2 thermocouples (TC)
• Generation of difference	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Measuring range	parameterizable max. -100 … 1100 mV
Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

SITRANS TR200 two-wire system, universal

Output	
Output signal	4 ... 20 mA, 2-wire
Auxiliary power	11 ... 35 V DC (to 30 V for Ex i/ic; to 32 V for Ex nA)
Max. load	$(U_{aux} - 11\ V)/0.023\ A$
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 mA ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reversed polarity
Electrically isolated	Input against output 2.12 kV DC (1.5 kV_{eff} AC)
Measuring accuracy	
Digital measuring errors	See Table "Digital measuring errors"
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10 °C (18 °F)
• Digital measuring errors	
- With resistance thermometer	0.06 °C (0.11 °F)/10 °C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10 °C (18 °F)
Auxiliary power effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of span in the first month
• After one year	< 0.2 % of span after one year
• After 5 years	< 0.3 % of span after 5 years
Conditions of use	
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	acc. to EN 61326 and NE21
Construction	
Material	Plastic, electronic module potted
Weight	122 g
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm^2 (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP20

Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 07 ATEX 2032X
• "Intrinsic safety" type of protection	II 2(1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 3 G Ex ic IIC T6/T4 II 2(1) D Ex iaD/ibD 20/21 T115 °C
• Type of protection, "equipment is non-arcing"	II 3 G Ex nA IIC T6/T4
Other certificates	NEPSI
Software requirements for SIPROM T	
PC operating system	Windows ME, 2000, XP, Win 7 and Win 8; can also be used in connection with RS 232 modem under Windows 95, 98 and 98SE

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
Pt50	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +649 (-328 ... +1200)	10	(18)	0.1	(0.18)
Pt500	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
Ni 25 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

Resistance-based sensors

Input	Measuring range	Min. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C/(°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1)]	(3.6)[1)]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.6)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2)]	(1.8)[2)]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.8)
Type K	-230 ... +1370 (-382 ... +2498)	50	(90)	1	(1.8)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

1) The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

2) The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring range	Min. measured span	Digital accuracy
	mV	mV	µV
mV sensor	-10 ... +70	2	40
mV sensor	-100 ... +1100	20	400

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.025 % of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

SITRANS TR200 two-wire system, universal

Selection and Ordering data	Article No.
Temperature transmitter SITRANS TR200	
For mounting on a standard DIN rail, two-wire system, 4 to 20 mA, programmable, with electrical isolation, with documentation on MiniDVD	
• Without explosion protection	**7NG3032-0JN00**
• With explosion protection to ATEX	**7NG3032-1JN00**
Further designs	Order code
Please add "**-Z**" to Article No. with and specify Order codes(s).	
With test protocol (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point no. (TAG), max. 8 characters	**Y17**[2]
Measuring point descriptor, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Text on front label, max. 16 characters	**Y29**[2][3]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[4]
Pt100 (IEC) 3-wire	**U03**[4]
Pt100 (IEC) 4-wire	**U04**[4]
Thermocouple type B	**U20**[4][5]
Thermocouple type C (W5)	**U21**[4][5]
Thermocouple type D (W3)	**U22**[4][5]
Thermocouple type E	**U23**[4][5]
Thermocouple type J	**U24**[4][5]
Thermocouple type K	**U25**[4][5]
Thermocouple type L	**U26**[4][5]
Thermocouple type N	**U27**[4][5]
Thermocouple type R	**U28**[4][5]
Thermocouple type S	**U29**[4][5]
Thermocouple type T	**U30**[4][5]
Thermocouple type U	**U31**[4][5]
With TC: CJC external (Pt100, 3-wire)	**U41**
With TC: CJC external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[6]
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**[2]

Accessories	Article No.
Modem for SITRANS TH100, TH200, TR200 and TF with TH200 incl. SIPROM T parameterization software With USB connection	**7NG3092-8KU**
MiniDVD for temperature measuring instruments for With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	**A5E00364512**

1) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
2) For this selection, Y01 or Y09 must also be selected.
3) Text on front plate is not saved in the device.
4) For this selection, Y01 must also be selected.
5) Internal cold junction compensation is selected as the default for TC.
6) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Supply units see Chapter "Supplementary Components".

Ordering example 1:

7NG3032-0JN00-Z Y01+Y17+Y29+U03
Y01: -10 ... +100 °C
Y17: TICA123
Y29: TICA123

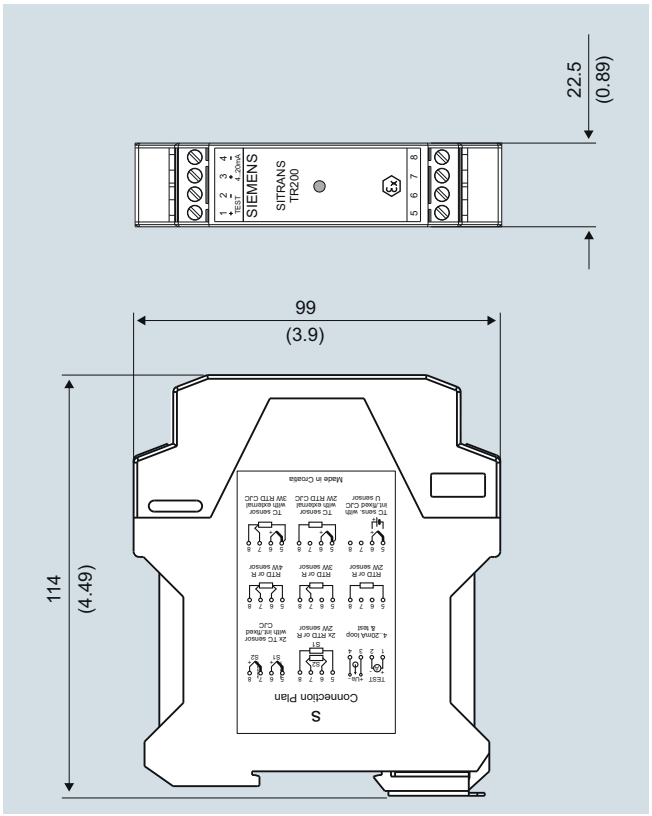
Ordering example 2:

7NG3032-0JN00-Z Y01+Y17+Y23+Y29+U25
Y01: -10 ... +100 °C
Y17: TICA123
Y23: TICA123HEAT
Y29: TICA123HEAT

Factory setting:

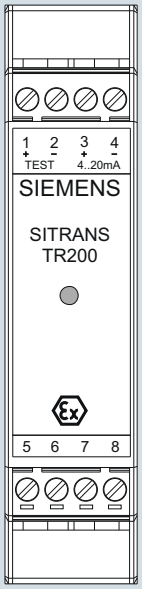
- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 … 100 °C (32 … 212 °F)
- Fault current: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Dimensional drawings



SITRANS TR200, dimensions in mm (inch)

Schematics

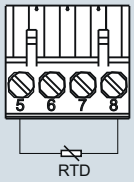
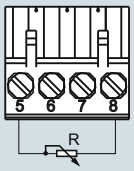
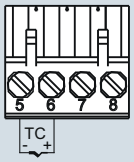
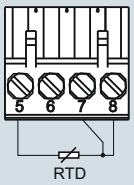
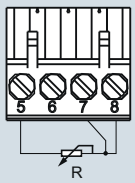
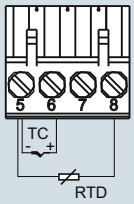
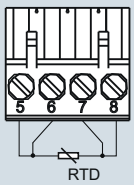
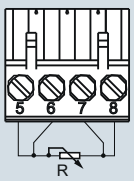
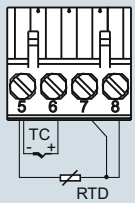
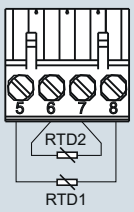
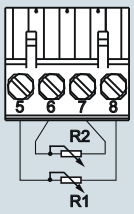
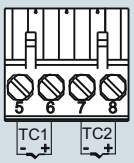


Asssignments

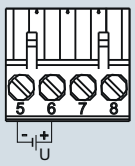
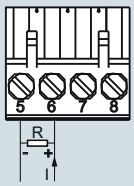
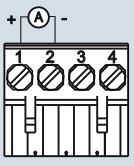
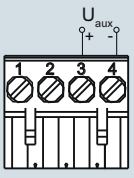
1 (+) and 2 (-)	Test terminals (test) for measurement of the output current with a multimeter
3 (+) and 4 (-)	Power supply U_{aux}, output current I_{out}
5, 6, 7 and 8	Sensor assignment, see schematics

SITRANS TR200, pin assignment

SITRANS TR200 two-wire system, universal

Resistance thermometer	Resistance	Thermocouple
 Two-wire system [1]	 Two-wire system [1]	 Cold junction compensation internal/fixed value
 Three-wire system	 Three-wire system	 Cold junction compensation with external Pt100 in two-wire system [1]
 Four-wire system	 Four-wire system	 Cold junction compensation with external Pt100 in three-wire system
 Generation of average value/difference [1]	 Generation of average value/difference [1]	 Generation of average value / difference with internal cold junction compensation

[1] Programmable line resistance for the purpose of correction.

Voltage measurement	Current measurement	Test terminals	Power supply/ 4 ... 20 mA (U_{aux})
			

SITRANS TR200, sensor connection assignment

Overview

"HART" to beat - the universal SITRANS TR300 transmitter

- Two-wire devices for 4 to 20 mA, HART
- Device for rail mounting
- Universal input for virtually any type of temperature sensor
- Configurable over HART

Benefits

- Compact design
- Electrically isolated
- Test sockets for multimeters
- Diagnostics LED (green/red)
- Sensor monitoring
  open circuits and short-circuits
- Self-monitoring
- Configuration status stored in EEPROM
- Expanded diagnostic functions, such as slave pointer, operating hours counter, etc.
- Special characteristic
- Electromagnetic compatibility to EN 61326 and NE21
- SIL2 (with Order Code C20), SIL2/3 (with C23)

Application

SITRANS TR300 transmitters can be used in all industrial sectors. Their compact design enables simple mounting on standard DIN rails on-site in protective boxes or in control cabinets. The following sensors/signal sources can be connected over their universal input module:

- Resistance thermometers (2, 3 or 4-wire system)
- Thermocouples
- Resistance-based sensors and DC voltage sources

The output signal is a direct current from 4 to 20 mA in accordance with the sensor characteristic, superimposed by the digital HART signal.

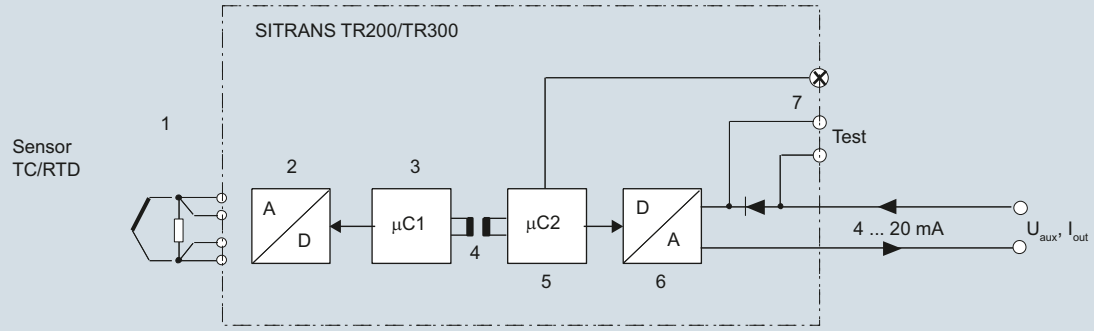
Transmitters of the "intrinsically safe" type of protection can be installed within potentially explosive atmospheres. The devices comply with the Directive 94/9/EC (ATEX).

Function

The SITRANS TR300 is configured over HART. This can be done using a handheld communicator or even more conveniently with a HART modem and the SIMATIC PDM parameterization software. The configuration data are then permanently stored in the non-volatile memory (EEPROM).

Once the sensors and power supply have been correctly connected, the transmitter outputs a temperature-linear output signal and the diagnostics LED displays a green light. In the case of a sensor short-circuit, the LED flashes red, an internal device fault is indicated by a steady red light.

The test socket can be used to connect an ammeter at any time for monitoring purposes and plausibility checks. The output current can be read without any interruption, or even without opening the current loop.



1 Sensor such as resistance thermometer, thermocouple, resistance-based, sensor, mV sensor
2 Analog-digital converter
3 Microcontroller, secondary circuit
4 Electrical isolation
5 Microcontroller, primary circuit
6 Digital-analog converter
7 LED

U_{aux} Auxiliary power supply
I_{out} Output current
Test Test terminals for temporary connection of an amperemeter

SITRANS TR300 function diagram

2

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• to JIS C 1604; a=0.00392 K^{-1}	Pt25 … Pt1000
• to IEC 60751	Ni25 … Pt1000
• Special type	over special characteristic (max. 30 points)
Sensor factor	0.25 ... 10 (adaptation of the basic type, e.g. Pt100 to version Pt25 ... 1000)
Units	°C or °F
Connection	
• Standard connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 identical resistance thermometers in 2-wire system for generation of average temperature
• Generation of difference	2 identical resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be isabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensors	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Normal connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance-based sensors in 2-wire system for generation of average value
• Generation of difference	2 resistance thermometers in 2-wire system (R1 – R2 or R2 – R1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: OFF)
Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. to ASTM 988
• Type E	NiCr-CuNi to DIN IEC 584
• Type J	Fe-CuNi to DIN IEC 584
• Type K	NiCr-Ni to DIN IEC 584
• Type L	Fe-CuNi to DIN 43710
• Type N	NiCrSi-NiSi to DIN IEC 584
• Type R	Pt13Rh-Pt to DIN IEC 584
• Type S	Pt10Rh-Pt to DIN IEC 584
• Type T	Cu-CuNi to DIN IEC 584
• Type U	Cu-CuNi to DIN 43710
Units	°C or °F
Connection	
• Standard connection	1 thermocouple (TC)
• Generation of average value	2 thermocouples (TC)
• Generation of difference	2 thermocouples (TC) (TC1 – TC2 or TC2 – TC1)
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60571 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time T_{63}	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off

Measuring range	parameterizable max. -100 … 1100 mV
Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic
Output	
Output signal	4 ... 20 mA, 2-wire with communication acc. to HART Rev. 5.9
Auxiliary power	11 ... 35 V DC (to 30 V for Ex i/ic; to 32 V for Ex nA)
Max. load	(U_{aux} –11 V)/0.023 A
Overrange	3.6 ... 23 mA, infinitely adjustable (default range: 3.84 ... 20.5 mA)
Error signal (e.g. following sensor fault) (conforming to NE43)	3.6 ... 23 mA, infinitely adjustable (default value: 22.8 mA)
Sample cycle	0.25 s nominal
Damping	Software filter 1st order 0 ... 30 s (parameterizable)
Protection	Against reversed polarity
Electrical isolation	Input against output (1 kV_{eff})
Measuring accuracy	
Digital measuring errors	see table "Digital measuring errors"
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Ambient temperature effect	
• Analog measuring errors of span	< 0.2 % of max. span/10 °C (18 °F)
• Digital measuring errors - at resistance thermometers - at thermocouples	 0.06 °C (0.11 °F)/10 °C (18 °F) 0.6 °C (1.1 °F)/10 °C (18 °F)
Auxiliary power effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of span in the first month
• After one year	< 0.2 % of span after one year
• After 5 years	< 0.3 % of span after 5 years
Conditions of use	
Ambient conditions	
Ambient temperature range	-40 ... +85 °C (-40 ... +185 °F)
Storage temperature range	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	< 98 %, with condensation
Electromagnetic compatibility	acc. to EN 61326 and NE21
Design	
Material	Plastic, electronic module potted
Weight	122 g
Dimensions	See "Dimensional drawings"
Cross-section of cables	Max. 2.5 mm² (AWG 13)
Degree of protection to IEC 60529	
• Enclosure	IP20

Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	PTB 07 ATEX 2032X
• "Intrinsic safety" type of protection	II 2(1) G Ex ia/ib IIC T6/T4 II 3(1) G Ex ia/ic IIC T6/T4 II 3 G Ex ic IIC T6/T4 II 2(1) D Ex iaD/ibD 20/21 T115 °C
• Type of protection, "equipment is non-arcing"	II 3 G Ex nA IIC T6/T4
Other certificates	NEPSI

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

2

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
Pt50	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +649 (-328 ... +1200)	10	(18)	0.1	(0.18)
Pt500	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
Ni 25 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

Resistance-based sensors

Input	Measuring range	Min. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1]	(3.6)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	2	(3.6)
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.8)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.8)
Type K	-230 ... +1370 (-382 ... +2498)	50	(90)	1	(1.8)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-200 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

[1] The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

[2] The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring range	Min. measured span	Digital accuracy
	mV	mV	µV
mV sensor	-10 ... +70	2	40
mV sensor	-100 ... +1100	20	400

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0,025 % of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

Selection and Ordering data	Article No.
Temperature transmitter SITRANS TR300	
For mounting on a standard DIN rail, two-wire system, 4 … 20 mA, HART, with electrical isolation, with documentation on MIniDVD	
• Without explosion protection	**7NG3033-0JN00**
• With explosion protection to ATEX	**7NG3033-1JN00**
Further designs	Order code
Please add "**-Z**" to Article No. with and specify Order codes(s).	
With test protocol (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Customer-specific programming	
Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[1]
Measuring point no. (TAG), max. 8 characters	**Y17**[2]
Measuring point descriptor, max. 16 characters	**Y23**[2]
Measuring point message, max. 32 characters	**Y24**[2]
Text on front label, max. 16 characters	**Y29**[2)3]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[4]
Pt100 (IEC) 3-wire	**U03**[4]
Pt100 (IEC) 4-wire	**U04**[4]
Thermocouple type B	**U20**[4)5]
Thermocouple type C (W5)	**U21**[4)5]
Thermocouple type D (W3)	**U22**[4)5]
Thermocouple type E	**U23**[4)5]
Thermocouple type J	**U24**[4)5]
Thermocouple type K	**U25**[4)5]
Thermocouple type L	**U26**[4)5]
Thermocouple type N	**U27**[4)5]
Thermocouple type R	**U28**[4)5]
Thermocouple type S	**U29**[4)5]
Thermocouple type T	**U30**[4)5]
Thermocouple type U	**U31**[4)5]
With TC: CJC external (Pt100, 3-wire)	**U41**
With TC: CJC external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[6]
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**[2]

Accessories	Article No.
MiniDVD for temperature measuring instruments	**A5E00364512**
With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	
HART modem	
• With USB connection	**7MF4997-1DB**
Simatic PDM operating software	**See Section 8**

1) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

2) For this selection, Y01 or Y09 must also be selected.

3) Text on front plate is not saved in the device.

4) For this selection, Y01 must also be selected.

5) Internal cold junction compensation is selected as the default for TC.

6) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Supply units see Chapter "Supplementary Components".

Ordering example 1:

7NG3033-0JN00-Z Y01+Y17+Y29+U03
Y01: -10 ... +100 °C
Y17: TICA123
Y29: TICA123

Ordering example 2:

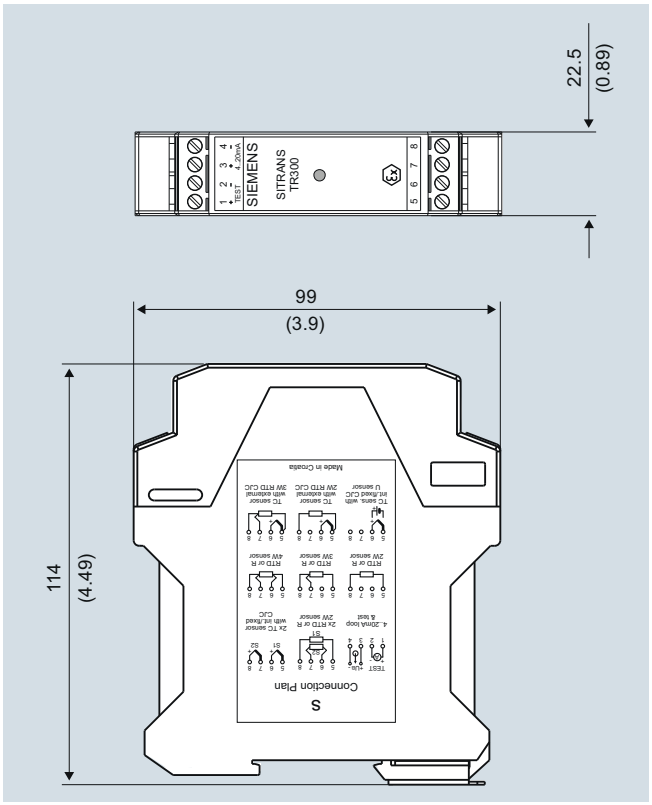
7NG3033-0JN00-Z Y01+Y17+Y23+Y29+U25
Y01: -10 ... +100 °C
Y17: TICA123
Y23: TICA123HEAT
Y29: TICA123HEAT

Factory setting:

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

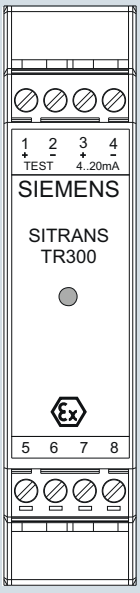
2

Dimensional drawings



SITRANS TR300, dimensions in mm (inch)

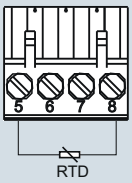
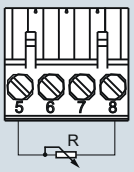
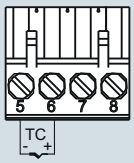
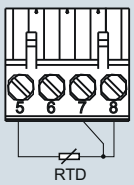
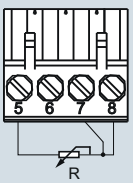
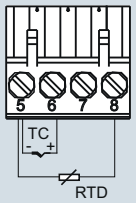
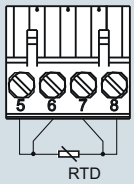
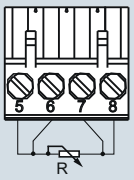
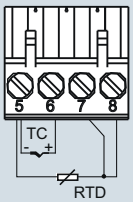
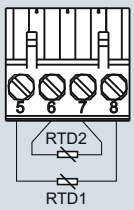
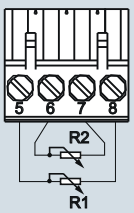
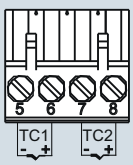
Schematics



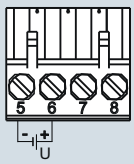
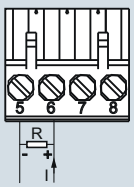
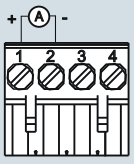
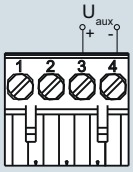
Assignments

1 (+) and 2 (-)	Test terminals (Test) for measurement of the output current with a multimeter
3 (+) and 4 (-)	Power supply U_{aux}, Output current I_{out}
5, 6, 7 and 8	Sensor assignment, see schematics

SITRANS TR300, pin assignment

Resistance thermometer	Resistance	Thermocouple
 Two-wire system [1]	 Two-wire system [1]	 Cold junction compensation internal/fixed value
 Three-wire system	 Three-wire system	 Cold junction compensation with external Pt100 in two-wire system [1]
 Four-wire system	 Four-wire system	 Cold junction compensation with external Pt100 in three-wire system
 Generation of average value/difference [1]	 Generation of average value/difference [1]	 Generation of average value / difference with internal cold junction compensation

[1] Programmable line resistance for the purpose of correction.

Voltage measurement	Current measurement	Test terminals	Power supply/ 4 ... 20 mA (U_{aux})
			

SITRANS TR300, sensor connection assignment

SITRANS TW four-wire system, universal, HART

Overview

The user-friendly transmitters for the control room

The SITRANS TW universal transmitter is a further development of the service-proven SITRANS T for the 4-wire system in a mounting rail housing. With numerous new functions it sets new standards for temperature transmitters.

With its diagnostics and simulation functions the SITRANS TW provides the necessary insight during commissioning and operation. And using its HART interface the SITRANS TW can be conveniently adapted with SIMATIC PDM to every measurement task.

All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

Application

The SITRANS TW transmitter is a four-wire rail-mounted device with a universal input circuit for connection to the following sensors and signal sources:

- Resistance thermometer
- Thermocouples
- Resistance-based sensors/potentiometers
- mV sensors
- As special version:
  - V sources
  - Current sources

The 4-wire rail-mounted SITRANS TW transmitter wire is designed for control room installation. It must not be mounted in potentially explosive atmospheres.

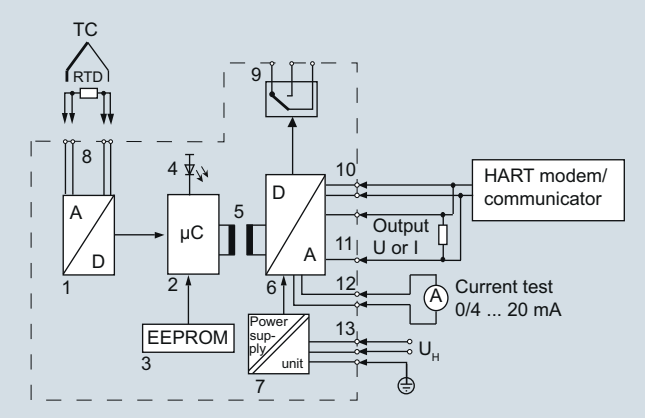
All SITRANS TW control room devices are available in a non-intrinsically safe version as well as in an intrinsically safe version for use with the most stringent requirements.

Function

Features

- Transmitter in four-wire system with HART interface
- Housing can be mounted on 35 mm rail or 32 mm G rail
- Screw plug connector
- All circuits electrically isolated
- Output signal: 0/4 to 20 mA or 0/2 to 10 V
- Power supplies: 115/230 V AC/DC or 24 V AC/DC
- Explosion protection [EEx ia] or [EEx ib] for measurements with sensors in the hazardous area
- Temperature-linear characteristic for all temperature sensors
- Temperature-linear characteristic can be selected for all temperature sensors
- Automatic correction of zero and span
- Monitoring of sensor and cable for open-circuit and short- circuit
- Sensor fault and/or limit can be output via an optional sensor fault/limit monitor
- Hardware write protection for HART communication
- Diagnostic functions
- Slave pointer functions
- SIL1

Mode of operation



The signal output by a resistance-based sensor (two-wire, three-wire, four-wire system), voltage source, current source or thermocouple is converted by the analog-to-digital converter (1, function diagram) into a digital signal. This is evaluated in the microcontroller (2), corrected according to the sensor characteristic, and converted by the digital-to-analog converter (6) into an output current (0/4 to 20 mA) or output voltage (0/2 to 10 V). The sensor characteristics as well as the electronics data and the data for the transmitter parameters are stored in the non-volatile memory (3).

AC or DC voltages can be used as the power supply (13). Any terminal connections are possible for the power supply as a result of the bridge rectifier in the power supply unit. The PE conductor is required for safety reasons.

A HART modem or a HART communicator permit parameterization of the transmitter using a protocol according to the HART specification. The transmitter can be directly parameterized at the point of measurement via the HART output terminals (10).

The operation indicator (4) identifies a fault-free or faulty operating state of the transmitter. The limit monitor (9) enables the signaling of sensor faults and/or limit violations. In the case of a current output, the current can be checked on a meter connected to test socket (12).

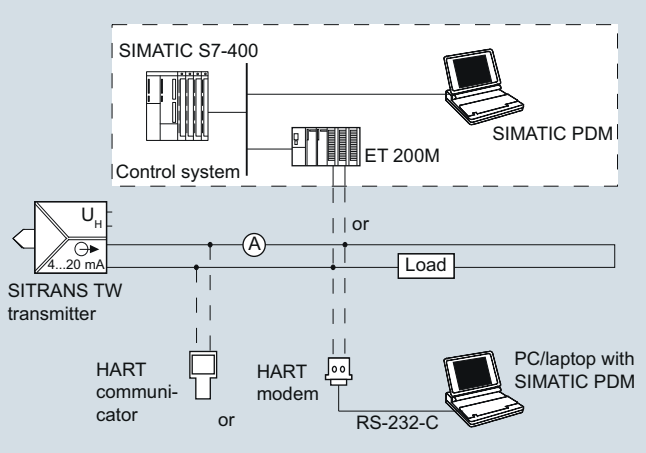
Diagnosis and simulation functions

The SITRANS TW comes with extensive diagnosis and simulation functions.

Physical values can be defined with the simulation function. It is thus possible to check the complete signal path from the sensor input to inside the control system without additional equipment. The slave pointer functions are used to record the minimum and maximum of the plant's process variable.

Integration

System configuration



Possible system configurations

The SITRANS TW transmitter as a four-wire rail-mounted device can be used in a number of system configurations: as a stand-alone version or as part of a complex system environment, e.g. with SIMATIC S7. All device functions are available via HART communication.

Communication options through the HART interface:

- HART communicator
- HART modem connected to PC/laptop on which the appropriate software is available, e.g. SIMATIC PDM
- HART-compatible control system (e.g. SIMATIC S7-400 with ET 200M)

Technical specifications

Input	
Selectable filters to suppress the line frequency	50 Hz, 60 Hz, also 10 Hz for special applications (line frequency filter is similar with measuring frequency)
Resistance thermometer	
Measured variable	Temperature
Measuring range	Parameterizable
Measuring span	min. 25 °C (45 °F) x 1/scaling factor
Sensor type	
• Acc. to IEC 751	Pt100 (IEC 751)
• Acc. to JIS C 1604-81	Pt100 (JIS C1604-81)
• to DIN 43760	Ni100 (DIN 43760)
• Special type ($R_{RTD} \leq 500\ \Omega$)	Multiples or parts of the defined characteristic values can be parameterized (e.g. Pt500, Ni120)
Characteristic curve	Temperature-linear, resistance-linear or customer-specific
Type of connection	• Normal connection • Sum or parallel connection • Mean-value or differential connection
Interface	2, 3 or 4-wire circuit
Measuring range limits	Depending on type of connected thermometer (defined range of resistance thermometer)
Sensor breakage monitoring	Monitoring of all connections for open-circuit (function can be switched off)
Sensor short-circuit monitoring	Parameterizable response threshold (function can be switched off)
Resistance-based sensor, potentiometer	
Measured variable	Actual resistance
Measuring range	Parameterizable
Measuring span	min. 10 Ω
Characteristic curve	Resistance-linear or customer-specific
Type of connection	• Normal connection • Differential connection • Mean-value connection
Interface	2, 3 or 4-wire circuit
Input range	0 ... 6000 Ω; with mean-value and difference circuits: 0 ... 3000 Ω
Sensor breakage monitoring	Monitoring of all connections for open-circuit (function can be switched off)
Sensor short-circuit monitoring	Parameterizable response threshold (function can be switched off)

SITRANS TW four-wire system, universal, HART

Thermocouples	
Measured variable	Temperature
Measuring range	Parameterizable
Measuring span	min. 50 °C (90 °F) x 1/scaling factor
Measuring range limits	Depend. on type of thermocouple element
Thermocouple element	Type B: Pt30 %Rh/Pt6 %Rh (DIN IEC 584)
	Type C: W5 %-Re (ASTM 988)
	Type D: W3 %-Re (ASTM 988)
	Type E: NiCr/CuNi (DIN IEC 584)
	Type J: Fe/CuNi (DIN IEC 584)
	Type K: NiCr/Ni (DIN IEC 584)
	Type L: Fe-CuNi (DIN 43710)
	Type N: NiCrSi-NiSi (DIN IEC 584)
	Type R: Pt13 %Rh/Pt (DIN IEC 584)
	Type S: Pt10 %Rh/Pt (DIN IEC 584)
	Type T: Cu/CuNi (DIN IEC 584)
	Type U: Cu/CuNi (DIN 43710)
	Special type (-10 mV ≤ UTC ≤ 100 mV)
Characteristic curve	Temperature-linear, voltage-linear or customer-specific
Type of connection	• Normal connection
	• Averaging connection
	• Mean-value connection
	• Differential connection
Cold junction compensation	None, internal measurement, external measurement or predefined fixed value
Sensor breakage monitoring	Function can be switched off
mV sensors	
Measured variable	DC voltage
Measuring range	Parameterizable
Measuring span	min. 4 mV
Input range	-120 ... +1000mV
Characteristic curve	Voltage-linear or customer-specific
Overload capacity of inputs	max. ± 3.5 V
Input resistance	≥ 1 MΩ
Sensor current	Approx. 180 µA
Sensor breakage monitoring	Function can be switched off
V sources	
Measured variable	DC voltage
Measuring range	Parameterizable
Characteristic curve	Voltage-linear or customer-specific
Input range/min. span	
• Devices with 7NG3242-xxxx**1** or 7NG3242-xxxx**0** with U/I plug	-1.2 ... + 10 V/0.04 V
• Devices with 7NG3242-xxxx**2**	-12 ... +100 V/0.4 V
• Devices with 7NG3242-xxxx**3**	-120 ... +140 V/4.0 V
Sensor breakage monitoring	Not possible

µA-, mA sources	
Measured variable	DC voltage
Measuring range	Parameterizable
Characteristic curve	Current-linear or customer- specific
Input range/min. span	
• Devices with 7NG3242-xxxx**4**	-12 ... +100 µA/0.4 µA
• Devices with 7NG3242-xxxx**5**	-120 ... +1000 µA/4 µA
• Devices with 7NG3242-xxxx**6**	-1.2 ... +10 mA/0.04 mA
• Devices with 7NG3242-xxxx**7** or 7NG3242-xxxx**0** with U/I plug	-12 ... +100 mA/0.4 mA
• Devices with 7NG3242-xxxx**8**	-120 ... +1000 mA/4 mA
Sensor breakage monitoring	Not possible
Output	
Output signal	Load-independent direct current 0/4 ... 20 mA, can be switched to load-independent DC voltage 0/2 ... 10 V using plug-in jumpers
Current 0/4 ... 20 mA	
• Overrange	-0.5 ... +23.0 mA, continuously adjustable
• Output range following sensor fault (conforming to NE43)	-0.5 ... +23.0 mA, continuously adjustable
• Load	≤ 650 Ω
• No-load voltage	≤ 30 V
Voltage 0/2 ... 10 V	
• Overrange	-0.25 ... +10.75 V, continuously adjustable
• Output range following sensor fault	-0.25 ... +10.75 V, continuously adjustable
• Load resistance	≥ 1 kΩ
• Load capacitance	≤ 10 nF
• Short-circuit current	≤ 100 mA (not permanently short-circuit-proof)
• Electrical damping	
- adjustable time constant T_{63}	0 ... 100 s, in steps of 0.1 s
• Current source/voltage source	Continuously adjustable within the total operating range
Sensor fault/limit signalling	By operation indicator, relay output or HART interface
Operation indicator	Flashing signal
• Limit violation	Flashing frequency 5 Hz
• Sensor fault monitoring	Flashing frequency 1 Hz
Relay outputs	Either as NO or NC contact with 1 changeover contact
• Switching capacity	≤ 150 W, ≤ 625 VA
• Switching voltage	≤ 125 V DC, ≤ 250 V AC
• Switching current	≤ 2.5 A DC
Sensor fault monitoring	Signalling of sensor or line breakage and sensor short-circuit
Limit monitoring	
• Operating delay	0 ... 10 s
• Monitoring functions of limit module	• Sensor fault (breakage and/or short-circuit) • Lower and upper limit • Window (combination of lower and upper limits) • Limit and sensor fault detection can be combined
• Hysteresis	Parameterizable between 0 and 100 % of measuring range

Auxiliary power	
Universal power supply unit	115/230 V AC/DC or 24 V AC/DC
Tolerance range for power supply	
• With 115/230 V AC/DC PSU	80 ... 300 V DC; 90 ... 250 V AC
• With 24 V AC/DC PSU	18 ... 80 V DC; 20.4 ... 55.2 V AC (in each case interruption-resistant up to 20 ms in the complete tolerance range)
Tolerance range for mains frequency	47 ... 63 Hz
Power consumption with	
• 230 V AC	≤ 5 VA
• 230 V DC	≤ 5 W
• 24 V AC	≤ 5 VA
• 24 V DC	≤ 5 W
Electrically isolated	
Electrically isolated circuits	Input, output, power supply and sensor fault/limit monitoring output are electrically isolated from one another. The HART interface is electrically connected to the output.
Working voltage between all electrically isolated circuits	The voltage U_{rms} between any two terminals must not exceed 300 V
Measuring accuracy	
Accuracy	
• Error in the internal cold junction	≤ 3 °C ± 0.1 °C / 10 °C (≤ 5.4 °F ± 0.18 °F / 18 °F)
• Error of external cold junction terminal 7NG3092-8AV	≤ 0.5 °C ± 0.1 °C / 10 °C (≤ 0.9 °F ± 0.18 °F / 18 °F)
• Digital output	See "Digital error"
• Analog output I_{AN} or U_{AN}	≤ 0.05 % of the span plus digital error
Influencing effects (referred to the digital output)	Compared to the max. span:
• Temperature drift	≤ 0.08 % / 10 °C (≤ 0.08 % /18 °F) ≤ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F)
• Long-term drift	≤ 0.1 % / year
Influencing effects referred to the analog output I_{AN} or U_{AN}	Compared to the span:
• Temperature drift	≤ 0.08 % / 10°C (≤ 0.08 % / 18 °F) ≤ 0.2 % in the range -10 ... +60 °C (14 ... 140 °F)
• Power supply	≤ 0.05 % / 10 V
• Load with current output	≤ 0.05 % on change from 50 Ω to 650 Ω
• Load with voltage output	≤ 0.1 % on change in the load current from 0 mA to 10 mA
• Long-term drift (start-of-scale value, span)	≤ 0.03 % / month
Response time (T_{63} without electrical damping)	≤ 0.2 s
Electromagnetic compatibility	According to EN 61 326 and NAMUR NE21

Certificates and approvals	
ATEX	To DIN EN 50014: 1997, EN 50020: 1994
Intrinsic safety to EN 50 020	
• for 7NG3242-x**A**xxx	II (1) G D [EEx ia/ib] IIB
• for 7NG3242-x**B**xxx	II (1) G D [EEx ia/ib] IIC
EC type-examination certificate	TÜV (German Technical Inspectorate) 01 ATEX 1675
Other certificates	GOST, NEPSI
Conditions of use	
Installation conditions	
Location (for devices with explosion protection)	
• Transmitters	Outside the potentially explosive atmosphere
• Sensor	Within the potentially explosive atmosphere zone 1 (also in zone 0 in conjunction with the prescribed protection requirements for the sensor)
Ambient conditions	
Permissible ambient temperature	-25 ... +70 °C (-13 ... +158 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Climatic class	
• Relative humidity	5 ... 95 %, no condensation
Design	
Weight	Approx. 0.24 kg (0.53 lb)
Enclosure material	PBT, glass-fibre reinforced
Degree of protection to IEC 529	IP20
Degree of protection to VDE 0100	Protection class I
Type of installation	35-mm DIN rail (1.38 inch) (EN 50022) or 32-mm G-type rail (1.26 inch) (EN 50035)
Electrical connection / process connection	Screw plug connectors, max. 2.5 mm^2 (0.01 $inch^2$)
Parameterization interface	
Protocol	HART, version 5.9
Load with connection of	
• HART communicator	230 ... 650 Ω
• HART modem	230 ... 500 Ω
Software for PC/laptop	SIMATIC PDM version V5.1 and later

SITRANS TW four-wire system, universal, HART

Digital error

Resistance thermometer

Input	Measuring range	Max. permissible line resistance	Digital error
	°C / (°F)	Ω	°C / (°F)
IEC 751			
• Pt10	-200 ... +850 (-328 ... +1562)	20	3.0 (5.4)
• Pt50	-200 ... +850 (-328 ... +1562)	50	0.6 (1.1)
• Pt100	-200 ... +850 (-328 ... +1562)	100	0.3 (0.5)
• Pt200	-200 ... +850 (-328 ... +1562)	100	0.6 (1.1)
• Pt500	-200 ... +850 (-328 ... +1562)	100	1.0 (1.8)
• Pt1000	-200 ... +850 (-328 ... +1562)	100	1.0 (1.8)
JIS C 1604-81			
• Pt10	-200 ... +649 (-328 ... +1200)	20	3.0 (5.4)
• Pt50	-200 ... +649 (-328 ... +1200)	50	0.6 (1.1)
• Pt100	-200 ... +649 (-328 ... +1200)	100	0.3 (0.5)
DIN 43760			
• Ni50	-60 ... +250 (-76 ... +482)	50	0.3 (0.5)
• Ni100	-60 ... +250 (-76 ... +482)	100	0.3 (0.5)
• Ni120	-60 ... +250 (-76 ... +482)	100	0.3 (0.5)
• Ni1000	-60 ... +250 (-76 ... +482)	100	0.3 (0.5)

Resistance-based sensors

Input	Measuring range	Max. permissible line resistance	Digital error
	Ω	Ω	Ω
Resistance (linear)	0 ... 24	5	0.08
	0 ... 47	15	0.06
	0 ... 94	30	0.06
	0 ... 188	50	0.08
	0 ... 375	100	0.1
	0 ... 750	100	0.2
	0 ... 1500	75	1.0
	0 ... 3000	100	1.0
	0 ... 6000	100	2.0

Thermocouples

Input	Measuring range	Digital error[1)]
	°C / (°F)	°C (°F)
Type B	0 ... +1820 (+32 ... +3308)	3 (5.4)
Type C	0 ... +2300 (+32 ... +4172)	2 (3.6)
Type D	0 ... +2300 (+32 ... +4172)	1 (1.8)
Type E	-200 ... +1000 (-328 ... +1832)	1 (1.8)
Type J	-210 ... +1200 (-346 ... +2192)	1 (1.8)
Type K	-200 ... +1372 (-328 ... +2501)	1 (1.8)
Type L	-200 ... +900 (-328 ... +1652)	2 (3.6)
Type N	-200 ... +1300 (-328 ... +2372)	1 (1.8)
Type R	-50 ... +1760 (-58 ... +3200)	2 (3.6)
Type S	-50 ... +1760 (-58 ... +3200)	2 (3.6)
Type T	-200 ... +400 (-328 ... +752)	1 (1.8)
Type U	-200 ... +600 (-328 ... +1112)	2 (3.6)

1) Accuracy data refer to the largest error in the complete measuring range

Voltage/current sources

Input	Measuring range	Digital error
mV sources (linear)	**mV**	**µV**
	-1 ... +16	35
	-3 ... +32	20
	-7 ... +65	20
	-15 ... +131	50
	-31 ... +262	100
	-63 ... +525	200
	-120 ... +1000	300
V sources (linear)	**V**	**mV**
	-1.2 ... +10	3
	-12 ... +100	30
	-120 ... +140	300
µA/mA sources (linear)	**µA/mA**	**µA**
	-12 ... +100 µA	0.05
	-120 ... +1000 µA	0.5
	-1.2 ... +10 mA	5
	-12 ... + 100 mA	50
	-120 ... +1000 mA	500

Ordering examples

Desired transmitter	Parameter: Standard	Parameter: Special	Ordering design
Example 1:			
SITRANS TW, transmitter in four-wire system			7NG3242-1AA00 (stock item)
• with explosion protection ATEX			
• 230 V AC/DC power supply			
• current output			
• without sensor fault/limit monitor			
- Sensor PT100, three-wire circuit	X		
- Measuring range 0 ... 150 °C	X		
- Temperature-linear characteristic	X		
- Filter time 1 s	X		
- Output 4 ... 20 mA, line filter 50 Hz	X		
- Output driven to full-scale in event of like breakage	X		
Example 2:			
SITRANS TW, transmitter in four-wire system			7NG3242-0BB10-Z Y01 + S76 + A05 + Y30 + H10 Y01: see Order code Y30: MA=0; ME= 950; D=C
• without explosion protection			
• 24 V AC/DC power supply			
• Voltage output			
• Sensor fault/limit monitor			
- Rating plate in English		S76	
- Sensor NiCr/Ni, type K		A05	
- Cold junction internal	X		
- Measuring range 0 ... 950 °C		Y30	
- Temperature-linear characteristic	X		
- Filter time 1 s	X		
- Output 0 ... 10 V, line filter 50 Hz		H10	
- Output driven to full-scale in event of like breakage	X		
- Limit monitoring switched off	X		
Example 3:			
SITRANS TW, transmitter in four-wire system			7NG3242-0BA01-Z Y01 + A40 + Y32 + G07 + H11 + J03 Y01: see Order code Y32: MA=0; ME= 5; D=V
• without explosion protection			
• 24 V AC/DC power supply			
• Current output			
• without sensor fault/limit monitor			
- Voltage input, measuring range -1.2 V ... +10 V		A40	
- Measuring range 0 ... 5 V		Y32	
- Source-proportional characteristic	X		
- Filter time 10 s		G07	
- Output 0 ... 20 mA, line filter 60 Hz		H11	
- No monitoring for sensor fault	(X)	J03	

Ordering information

The article number structure shown below is used to specify a fully functioning transmitter. The selection of the operating data (type of source, measuring range, characteristic etc.) is made according to the following rules:

- Operating data already set in factory to default values:
  The default settings can be obtained from the list of parameterizable operating data (see "Special operating data"). The presets can be modified by the customer to match the requirements precisely.
- Operating data set on delivery according to customer requirements:
  Supplement the Article No. by "**-Z**" and add the Order code "Y01". The operating data to be set can be obtained from the list of parameterize operating data. The Order codes A■■ to K■■ for operating data to be set need only be specified in the order if they deviate from the default setting.
  The default setting is used if no Order code is specified for operating data.

The selected parameters are printed on the transmitter's rating plate.

SITRANS TW four-wire system, universal, HART

Selection and Ordering data	Article No.
SITRANS TW universal transmitter ↗ for rail mounting, in four-wire system (order instruction manual separately) ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	**7NG3242-** ■■■■■
Explosion protection	
Without	**0**
For inputs [EEx ia] or [EEx ib]	**1**
Power supply	
115/230 V AC/DC	**A**
24 V AC/DC	**B**
Output signal	
0/4 ... 20 mA (can be switched to 0/2 ... 10 V)	**A**
0/2 ... 10 V (can be switched to 0/4 ... 20 mA)	**B**
Sensor fault/limit monitor	
Without (retrofitting not possible)	**0**
Relay with changeover contact	**1**
Input for	
Temperature sensor, resistance-based sensor and mV sensor with measuring range -120 ... +1000 mV DC and with U/I plug	**0**
Voltage input (V sources) [1] Measuring range:	
• -1.2 ... +10 V DC	**1**
• -12 ... +100 V DC (not Ex version)	**2**
• -120 ... +140 V DC (not Ex version)	**3**
Current input (µA, mA sources) [1] Measuring range:	
• -12 ... +100 µA DC	**4**
• -120 ... +1000 µA DC	**5**
• -1.2 ... +10 mA DC	**6**
• -12 ... +100 mA DC	**7**
• -120 ... +1000 mA DC	**8**
Further designs Please add "-**Z**" to Article No. and specify Order code(s) (see "List of parameterizable operating data").	Order code
Customer-specific setting of operating data (see "List of parameterizable operating data") **Note:** specify in plain text: „see Order code“	**Y01**
Meas. point description (max. 16 char.)	**Y23**
Text on front of device (max. 32 char.)	**Y24**
HART tag (max. 8 characters)	**Y25**
With test report	**P01**
With shorting plug to HART communication for 0 mA or 0 V	**S01**
With plug for external cold junction compensation	**S02**
With U/I plug (-1.2 ... +10 V DC or -12 ... +100 mA)	**S03**
Language of rating plate (together with Y01 Order Code only)	
• Italian	**S72**
• English	**S76**
• French	**S77**
• Spanish	**S78**

[1] Observe max. values with Ex version.

Selection and Ordering data	Article No.
Accessories	
MiniDVD for temperature measuring instruments With documentation in German, English, French, Spanish, Italian, Portuguese and SIPROM T parameterization software	**A5E00364512**
Instruction Manual for SITRANS TW	
German/English	**A5E00054075**
French/Italian/Spanish	**A5E00064515**
Cold junction terminal	**7NG3092-8AV**
U/I plug (-1.2 ... +10 V DC pr -12 ... +100 mA)	**7NG3092-8AW**
SIMATIC PDM operating software	**See Chapter 8**
HART modem	
With USB interface	**7MF4997-1DB**

List of parameterizable operating data (Order codes A ■■ + B ■■ ... E ■■)

Operating data acc. to default setting Article No. with Order code: 7NG3242 - ■■■■■ -Z Y01

Order codes: A ■■ ... E ■■ | ■■■ | + | ■■■ | + | ■■■ | + | ■■■ | + | ■■■

Sensor

Thermocouples

Type	Temperature range	
B: Pt30 %Rh/Pt6 %Rh	0 ... 1820 °C	A 0 0
C:W5 %Re	0 ... 2300 °C	A 0 1
D:W3 %Re	0 ... 2300 °C	A 0 2
E:NiCr/CuNi	-200 ... +1000 °C	A 0 3
J:Fe/CuNi (IEC)	-210 ... +1200 °C	A 0 4
K:NiCr/Ni	-200 ... +1372 °C	A 0 5
L: Fe/CuNi (DIN)	-200 ... +900 °C	A 0 6
N:NiCrSi/NiSi	-200 ... +1300 °C	A 0 7
R:Pt13 %Rh/Pt	-50 ... +1760 °C	A 0 8
S:Pt10 %Rh/Pt	-50 ... +1760 °C	A 0 9
T:Cu/CuNi (IEC)	-200 ... +400 °C	A 1 0
U:Cu/CuNi (DIN)	-200 ... +600 °C	A 1 1

Resistance thermometer
(or max. permissible line resistance see „Technical specifications“)

Pt100 (DIN IEC)	-200 ... +850 °C	A 2 0
Pt100 (JIS)	-200 ... +649 °C	A 2 1
Ni100 (DIN)	-60 ... +250 °C	A 2 2

Resistance-based sensors, potentiometers
(or max. permissible line resistance see „Technical specifications“)

A 3 0

mV, V and µA, mA sensors [9]

A 4 0

Connection

Standard		B 0 1
Sum n [1]	n = 2	B 0 2
	...	. . .
	n = 10	B 1 0
Difference [2]	Diff1	B 3 1
	Diff2	B 3 2
Mean-val. [2]	MW	B 4 1

Resistance thermometer

Standard		B 0 1
Sum n [4]	n = 2	B 0 2
	...	. . .
	n = 10	B 1 0
Parallel n [5]	n = 0.1	B 2 1
	n= 0.2	B 2 2
	n= 0.5	B 2 5
Special value [6] [7]		Y 0 0
Difference [2]	Diff1	B 5 1
	Diff2	B 5 2
Mean-val. [2]	MW	B 6 1

Resistance-based sensors, potentiometers

Standard		B 0 1
Difference [2]	Diff1	B 5 1
	Diff2	B 5 2
Mean val. [2]	MW	B 6 1

Meas. range with Article No. 7NG 3242 - ■■■■■

Cold junction compensation

None		C 0 0
Internal		C 1 0
Fixed val.	0 °C	C 2 0
	20 °C	C 2 2
	50 °C	C 2 5
	60 °C	C 2 6
	70 °C	C 2 7
Special value [7]		Y 1 0
External meas. (through Pt100 DIN IEC 751) [7]		Y 1 1

Resistance thermometer

2-wire-system		C 3 2
3-wire-system		C 3 3
4-wire-system		C 3 4

Resistance-based sensors, potentiometers

2-wire-system		C 3 2
3-wire-system		C 3 3
4-wire-system		C 3 4

Line resistance [3]

Resistance thermometer

0 Ω		D 0 0
10 Ω		D 1 0
20 Ω		D 2 0
50 Ω		D 5 0
Special val. [7]		Y 2 0

Resistance-based sensors, potentiometers

0 Ω		D 0 0
10 Ω		D 1 0
20 Ω		D 2 0
50 Ω		D 5 0
Special val. [7]		Y 2 0

Measuring ranges

-30 ... +60 °C	E 0 0
-20 ... +20 °C	E 0 1
0 ... 40 °C	E 0 2
0 ... 60 °C	E 0 3
0 ... 80 °C	E 0 4
0 ... 100 °C	E 0 5
0 ... 120 °C	E 0 6
0 ... 150 °C	E 0 7
0 ... 200 °C	E 0 8
0 ... 250 °C	E 0 9
0 ... 300 °C	E 1 0
0 ... 350 °C	E 1 1
0 ... 400 °C	E 1 2
0 ... 450 °C	E 1 3
0 ... 500 °C	E 1 4
0 ... 600 °C	E 1 5
0 ... 700 °C	E 1 6
0 ... 800 °C	E 1 7
0 ... 900 °C	E 1 8
0 ... 1000 °C	E 1 9
0 ... 1200 °C	E 2 0
0 ... 1400 °C	E 2 1
0 ... 1600 °C	E 2 2
0 ... 1800 °C	E 2 3
50 ... 100 °C	E 2 4
50 ... 150 °C	E 2 5
100 ... 200 °C	E 2 6
100 ... 300 °C	E 2 7
100 ... 400 °C	E 2 8
200 ... 300 °C	E 2 9
200 ... 400 °C	E 3 0
200 ... 500 °C	E 3 1
300 ... 600 °C	E 3 2
500 ... 1000 °C	E 3 3
600 ... 1200 °C	E 3 4
800 ... 1600 °C	E 3 5
Special range [7]	Y 3 0

Resistance-based sensors, potentiometers

0 ... 100 Ω	E 4 0
0 ... 200 Ω	E 4 1
0 ... 500 Ω	E 4 2
0 ... 1000 Ω	E 4 3
0 ... 2500 Ω	E 4 4
0 ... 5000 Ω [8]	E 4 5
0 ... 6000 Ω [8]	E 4 6
Special range [7]	Y 3 1

-Z Y01

0	-120 ... +1000 mV
1	-1,2 ... +10 V [10]
2	-12 ... +100 V [10]
3	-120 ... +140 V [10]
4	-12 ... +100 µA [10]
5	-120 ... +1000 µA [10]
6	-1,2 ... +10 mA [10]
7	-12 ... +100 mA [10]
8	-120 ... +1000 mA [10]
	Special range [7]

E 5 0

Y 3 2

1) n = number of thermocouple elements to be connected in series
2) See „Circuit diagrams“ for meaning of type circuit
3) Line resistance of channels 1 and 2, for max. permissible line resistance see „Technical specifications“ (only with C32, not with C33 and C34)
4) n = number of resistance thermometers to be connected in series
5) 1/n = number of resistance thermometers to be connected in parallel
6) Combination of series and parallel connection of resistance thermometers
7) Operating data: see „Special operating data“
8) This range does not apply to mean-value and difference circuits.
9) The max. permissible currents and voltages according to conformity certificate must be observed in devices with explosion protection.
10) Without detection of line breakage

2

List of parameterizable operating data (Order codes F ■■ ... K ■■)

Operating data according to default setting

Article No. with Order code: 7NG3242 - ■■■■■ -Z Y01

Order codes: F ■■ ... K ■■ | ■■■ | + | ■■■ | + | ■■■ | + | ■■■ | + | ■■■ | | ■■■

Sensor

Thermocouple elements

Type	Temperature range	
B: Pt30 %Rh/	0 ... 1820 °C	A 0 0
C:W5 %Re	0 ... 2300 °C	A 0 1
D:W3 %Re	0 ... 2300 °C	A 0 2
E:NiCr/CuNi	-200 ... +1000 °C	A 0 3
J:Fe/CuNi (IEC)	-210 ... +1200 °C	A 0 4
K:NiCr/Ni	-200 ... +1372 °C	A 0 5
L: Fe/CuNi (DIN)	-200 ... +900 °C	A 0 6
N:NiCrSi/NiSi	-200 ... +1300 °C	A 0 7
R:Pt13 %Rh/Pt	-50 ... +1760 °C	A 0 8
S:Pt10 %Rh/Pt	-50 ... +1760 °C	A 0 9
T:Cu/CuNi (IEC)	-200 ... +400 °C	A 1 0
U:Cu/CuNi (DIN)	-200 ... +600 °C	A 1 1

Voltage measurement

Temperature-linear	F 0 0
Voltage-linear	F 1 0

Filter time[1]

0 s	G 0 0
0.1 s	G 0 1
0.2 s	G 0 2
0.5 s	G 0 3
1 s	G 0 4
2 s	G 0 5
5 s	G 0 6
10 s	G 0 7
20 s	G 0 8
50 s	G 0 9
100 s	G 1 0
Special time[5]	Y 5 0

Output signal and line filter[2]

4 ... 20 mA/ 2 ... 10 V with line filter:	
50 Hz	H 0 0
60 Hz	H 0 1
10 Hz[4]	H 0 2
0 ... 20 mA/ 0 ... 10 V with line filter:	
50 Hz	H 1 0
60 Hz	H 1 1
10 Hz	H 1 2

Failure signal

with line breakage/fault:	
to full scale	J 0 0
to start of scale	J 0 1
hold last value	J 0 2
no monitoring	J 0 3
Safety value[5]	Y 6 0

Limit monitor[3]

Limit monitoring ineffective (but sensor fault signalling with closed-circuit operation)	K 0 0
Effective[5]	Y 7 0

Resistance thermometer
(max. permissible line resistances see „Technical specifications“)

Pt100 (DIN IEC)	-200 ... +850 °C	A 2 0
Pt100 (JIS)	-200 ... +649 °C	A 2 1
Ni100 (DIN)	-60 ... +250 °C	A 2 2

Voltage measurement

Temperature-linear	F 0 0
Resistance-linear	F 2 0

Filter time[1]: same as for thermocouple elements

Output signal and line filter[2]: same as for thermocouple elements

Failure signal

with line breakage/fault:	
to full scale	J 0 0
to start of scale	J 0 1
hold last value	J 0 2
no monitoring	J 0 3
Safety value[5]	Y 6 0
with line breakage or short-circuit/fault:	
to full scale	J 1 0
to start of scale	J 1 1
hold last value	J 1 2
no monitoring	J 1 3
Safety value[5]	Y 6 1

Limit monitor[3]: same as for thermocouple elements

Resistance-based sensors, potentiometers

(max. permissible line resistances see „Technical specifications“) A 3 0

Voltage measurement

Resistance-linear	F 2 0

Filter time[1]: same as for thermocouple elements

Output signal and line filter[2]: same as for thermocouple elements

Failure signal

with line breakage/fault:	
to full scale	J 0 0
to start of scale	J 0 1
hold last value	J 0 2
no monitoring	J 0 3
Safety value[5]	Y 6 0

Limit monitor[3]: same as for thermocouple elements

mV, V and µA, mA sources A 4 0

Voltage measurement

Source proportional	F 3 0

Filter time[1]: same as for thermocouple elements

Output signal and line filter[2]: same as for thermocouple elements

Limit monitor[3]: same as for thermocouple elements

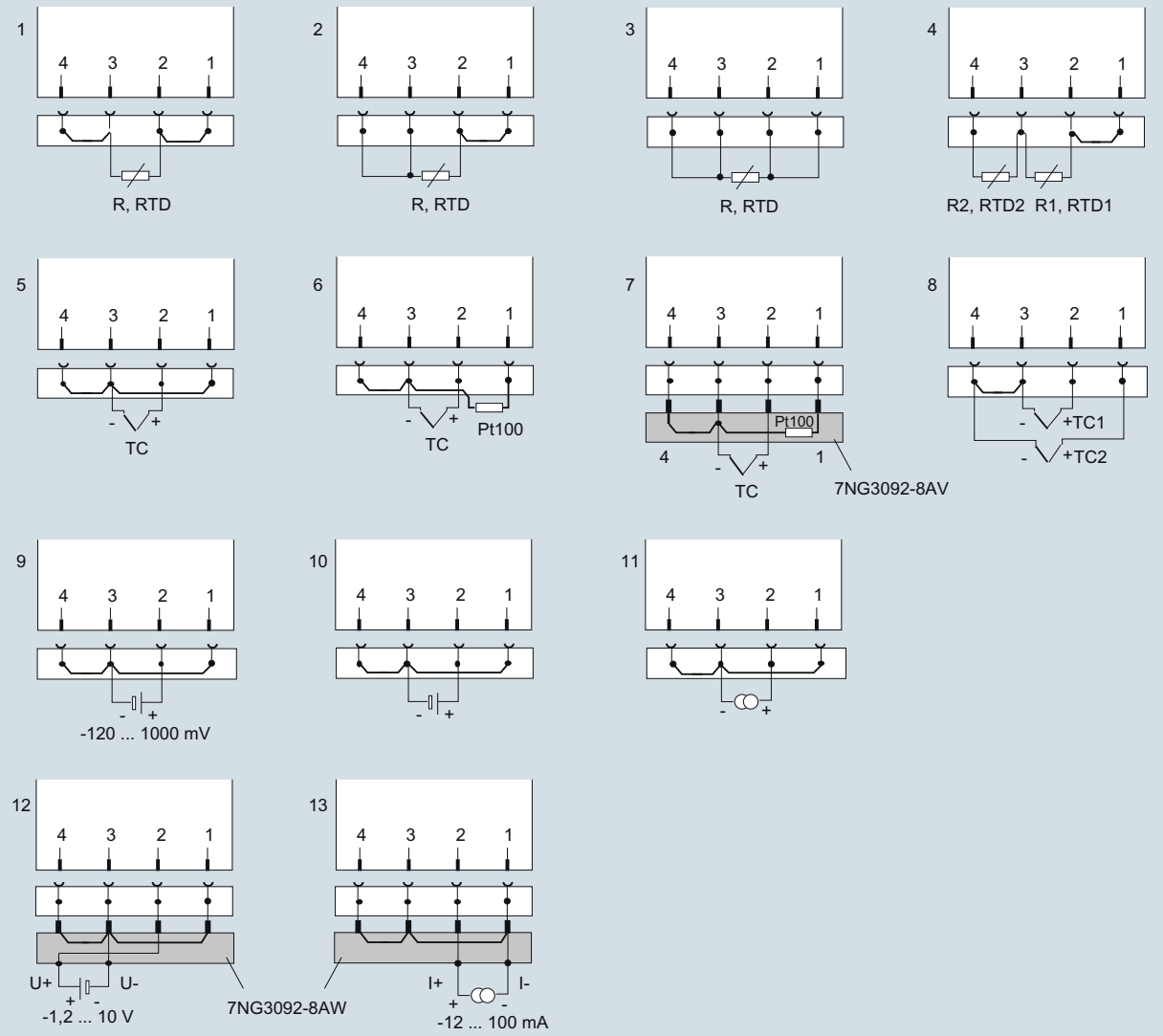
1) Software filter to smooth the result
2) Filter to suppress line disturbances on the measured signal.
3) If signalling relay present
4) for special appliciations
5) Operating data: see „Special operating data“

Special operating data

Order code	Plain text required	Options
Y00	N=□□.□□	Factor N for multiplication with the characteristic values of resistance thermometers
		Range of values: 0.10 to 10.00
		1. Example: 3 x Pt500 parallel: N = 5/3 = 1.667; 2. Example: Ni120: N = 1.2
Y10	TV=□□□□.□□	Temperature TV of the fixed cold junction
	D=□	Dimension; range of values: C, K, F, R
Y11	RL=□□□.□□	Line resistance RL in Ω for compensation of cold junction line of external Pt100 DIN IEC 751
		Range of values: 0.00 to 100.00
Y20	RL1=□□□.□□ RL2=□□□.□□	Line resistances RL of channel 1 (RL1) and channel 2 (RL2) in Ω if the resistance thermometer or the resistance-based sensor is connected in a two-wire system
		Range of values depending on type of sensor: 0.00 to 100.00
Y30	MA=□□□□.□□ ME=□□□□.□□	Start-of-scale value MA and full-scale value ME for thermocouples and resistance thermometers
		(Range of values depending on type of sensor)
	D=□	Dimension, range of values: C, K, F, R)
Y31	MA=□□□□.□□ ME=□□□□.□□	Start-of-scale value MA and full-scale value ME for resistance-based sensors or potentiometers in Ω
		Range of values: 0.00 to 6,000.00
Y32	MA=□□□□.□□ ME=□□□□.□□	Start-of-scale value MA and full-scale value ME for mV, V, µA and mA sources
		Range of values depending on type of sensor: -120.00 to 1,000.00
	D=□□	Dimension (mV entered as MV, V as V, µA as UA, mA as MA)
Y50	T63=□□□.□	Response time T63 of software filter in s
		Range of values: 0.0 to 100.0
		Safety value S of signal output in mA or in V corresponding to the set type of output. Range of values - with current output: -0.50 to 23.00 - with voltage output: -0.25 to 10.75
Y60	S=□□.□□	Safety value S with line breakage of sensor
Y61	S=□□.□□	Safety value S with line breakage or short-circuit of sensor
Y70	UG=□□□□.□□	Lower limit value (dimension as defined by measuring range)
	OG=□□□□.□□	Upper limit value (dimension as defined by measuring range)
	H=□□□□.□□	Hysteresis (dimension as defined by measuring range)
	K=□	Switch on/off combination of limit function and sensor fault detection; J=on; N=off (standard: J)
	A=□	Type of relay output: A=open-circuit operation; R=closed-circuit operation (standard: R)
	T=□□.□	Switching delay T of relay output in s
		Range of values: 0.0 to 10.0 (standard: 0.0)

Schematics

Sensor input connections



Resistance thermometers, resistance-based sensors, potentiometers:

1 Two-wire system; resistance can be parameterized for line compensation

2 Three-wire system

3 Four-wire system

4 Difference/mean-value circuit; 2 resistors can be parameterized for line compensation

Thermocouples:

5 Determination of cold junction temperature using built-in Pt100 or fixed reference temperature

6 Determination of cold junction temperature using external Pt100; resistance can be parameterized for line compensation

7 Determination of cold junction temperature using cold junction terminal 7NG3092-8AV

8 Difference/mean-value circuit with internal cold junction temperature

Further sources:

9 mV sources with two-wire system (7NG3242-xxxx0)

10 V sources with two-wire system (7NG3242-xxxx[1-3])

11 mA/mA sources with two-wire system (7NG3242-xxxx[4-8])

12 Voltage measurement -1,2 to 10 V with U/I plug 7NG3092-8AW (7NG3242-xxxx0)

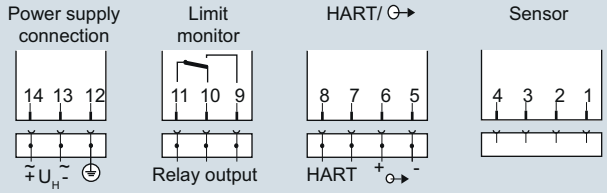
13 Current measurement -12 to 100 mA with U/I plug 7NG3092-8AW (7NG3242-xxxx0)

Connection diagram for the input signal

Channel 1 is the measured variable between the terminals 2 and 3 on the input plug. With a difference or mean-value circuit, the calculation of the measured value is defined by the type of measurement. Otherwise the measured value is determined via channel 1. The following code is used for the type of measurement:

type of measurement	Calculation of measured value
Single channel	Channel 1
Differential connection 1	Channel 1 - Channel 2
Differential connection 2	Channel 2 - Channel 1
Mean-value 1	½ · (Channel 1 + Channel 2)

The short-circuit jumpers shown in the circuits must be inserted in the respective system on site.



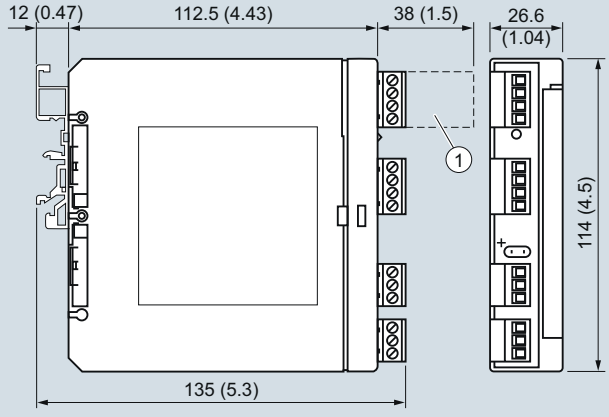
1 to 4	Signal input (see "sensor input connections" for possible types of connection)
5, 6	Analog output (U or I output parameterizable using plug-in jumpers)
7, 8	Connection with HART communication for local parameterization
9 to 11	Output for sensor fault/limit monitor as relay contact (see below for possible parameterization)
12	PE connection
13, 14	Power supply input (protected against reverse polarity)

Connection diagram for power supply, input and outputs

Relay outputs

	Connected terminals
Closed-circuit operation (relay opens when error)	
• Device switched off	10 and 11
• Device switched on and no error	9 and 11
• Device switched on and error	10 and 11
Open-circuit operation (relay closes when error)	
• Device switched off	10 and 11
• Device switched on and no error	10 and 11
• Device switched on and error	9 and 11

Dimensional drawings



(1) In devices with explosion protection

Dimensions for control room mounting, rail mounting in mm (inches)

SITRANS TF280 WirelessHART

Overview

SITRANS TF280 for flexible and cost-effective temperature measurements

- Supports the WirelessHART standard (HART V 7.1)
- Very high security level for wireless data transmission
- Built-in local user interface (LUI) with 3-button operation
- Optimum representation and readability using graphical display (104 x 80 pixels) with integrated backlight
- Stand-by (deep sleep phase) mode can be turned on and off with push of a button
- Battery power supply
- Battery life time up to 5 years
- Extend battery life time with HART modem interface which can be switch off
- Optimized power consumption through new design, and increase in battery life time
- Simple configuration thanks to SIMATIC PDM
- Housing meets IP65 degree of protection
- Supports all Pt100 sensors as per IEC 751/DIN EN 60751

Benefits

The SITRANS TF280 is a temperature transmitter that features WirelessHART as the standard communication interface.

Also available is a wired interface to connect a HART modem:

- Flexible temperature measurement
- Save costs on wiring at difficult installation conditions. Wireless technology offers cost advantages in cases where extensive wiring costs would normally apply.
- It enables additional hitherto unfeasible measuring points, particularly for monitoring purposes
- Easy installation also on moveable equipment parts
- Enables cost-effective temporary measurements, for example for process optimizations.
- Optimum solution in addition to wired communication and for system solutions in process automation

Application

The SITRANS TF280 is a WirelessHART field device for temperature measurement with a Pt100 sensor.

This sensor can be installed directly on the field device, or connected at an offset with a cable connection. On the wireless communication side, the transmitter supports the WirelessHART standard. A HART modem can be connected to the transmitter particularly for initial parameterization. Alternatively the device can be commissioned comfortably by means of the local push-buttons w/o any additional handset devices.

It can be used in all industries and applications in non-explosive areas.

Design

The SITRANS TF280 has a robust aluminum enclosure and is suitable for outside use. It conforms with the IP65 safety class.

The operation temperature range is -40 to +80 °C (-40 to +176 °F). Power supply is provided through an integrated battery, which is available as an accessory. The device is only approved for operation with this battery.

The antenna features a rotatable joint which can be used for directional alignment. Wireless signals can thus be optimally received and transmitted.

A special highlight is the possibility to operate directly on the device with 3 push buttons. It perfectly matches the strategy of all new Siemens field devices.

Using the device's push buttons, it is easy to turn the HART modem interface of the device on and off. The device can be put to passive status and reactivated at any time. This helps to extend the life time of the battery.

The SITRANS TF280 transmitter features a cable gland or a Pt100 sensor including protective piping.

Function

The SITRANS TF280 can join to a WirelessHART network. It can be parameterized and operated through this network. Measured process values are transmitted via the network to the SIEMENS IE/WSN-PA LINK.

Field device data received by the IE/WSN-PA LINK is transmitted to the connected systems, for example the process control system SIMATIC PCS 7. For an introduction of WirelessHART, please see the FI 01 catalogue Sec. 8 or www.siemens.com/wirelesshart.

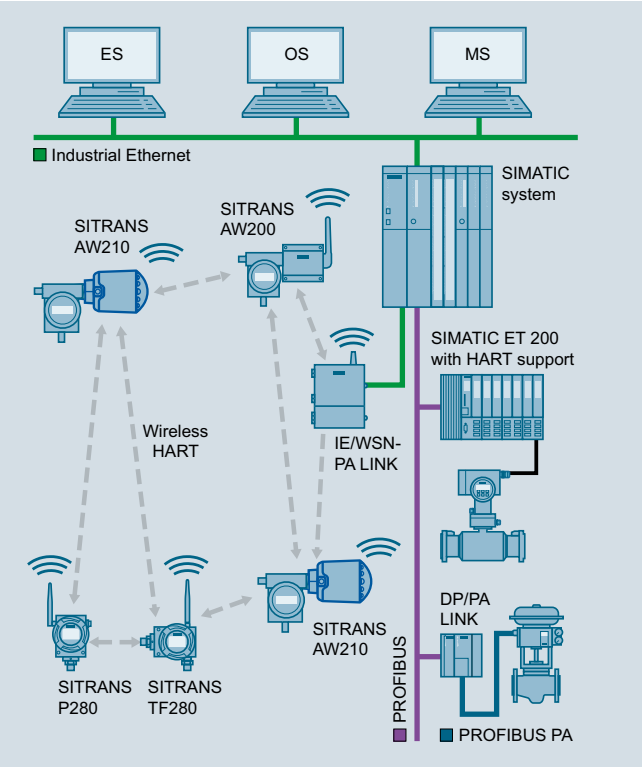
Detailed information on IE/WSN-PA LINK can be found in the FI 01 catalogue Sec. 7 or www.siemens.com/wirelesshart.

Integration

Connecting to SIMATIC PCS 7

The integration of field devices in SIMATIC PCS 7 and other process control systems can be now done seamlessly and cost-effectively with wireless technology, especially in situations where high wiring costs may be expected. Of particular interest are measuring points which are to be added and for which no wiring is available.

Where larger distances between the IE/WSN-PA LINK and control systems need to be overcome, this connection can also be implemented on a wireless and cost-effective basis using the SCALANCE W series of products. Siemens WirelessHART devices operate with optimum coexistence to SCALANCE W family products.



Integration of a meshed network into SIMATIC PCS 7

Configuration

Configuration of the SITRANS TF280 transmitter may be carried out as follows:

- Initial commissioning for the SITRANS TF280 with SIMATIC PDM is generally carried out via a HART modem or the integrated local user interface, since the network ID and join Key must be set up on the device before it can be accepted and integrated into the WirelessHART network.
- Once it is integrated into the network, the device can be conveniently operated with the WirelessHART network or onsite with a HART modem or via the local user interface.

Technical specifications

The SITRANS TF280 can be mechanically installed in two ways:

- Direct at the measuring point with a M20x1.5 thread. A connection to other threads can be done via the adapter.
- Remotely from the Pt100 sensor, which is connected to the transmitter via a cable.

The data in the following table refer to the transmitter only excluding a connected sensor, except as noted otherwise.

Input	
Sensor	
• Sensor type	Pt100 as per IEC 751/DIN EN 60751[1)]
• Connection	Two, three or four-wire system
• Measuring range	-200 ... +850 °C (-328 ... 1560 °F)
Cable length SITRANS TF280 and Pt100 sensor element	≤ 3 m
Measuring accuracy[2)]	
Accuracy	< 0.04 % of the measuring range
Long-term drift	< 0.035 % of the measuring range in first year
Ambient temperature effect	max. 0.1 °C/10 K
Rated conditions	
Ambient temperature	-40 ... +80 °C (-40 ... +176 °F)
Storage temperature	-40 ... +85 ° C (-40 ... +185 °F)
Relative humidity	< 95%
Climatic class	4K4H in accordance with EN 60721-3-4 (stationary use at locations not protected against weather)
Degree of protection	IP65/NEMA 4
Max. permissible temperature at transmitter for directly mounted Pt100	80 °C (176 °F)
Design	
Enclosure	Die-cast aluminum
Shock resistance	in accordance with DIN EN 60068-2-29 / 03.95
Resistance to vibration	DIN EN 60068-2-6/12.07
Weight	
• without battery	1.5 kg (3.3 lb)
• with battery	1.6 kg (3.5 lb)
Dimensions (W x H x D)	See "Dimensional drawing"
Thread for cable gland/ sensor connection	M20x1.5 other threads via adapter
Material of protective tubes and process connection (only for premounted sensor pipe)	Stainless steel 1.4404 (AISI 316L, UNS S 31603, X2CrNiMo17-12-2)
Cable between transmitter and sensor element	≤ 3 m für two-, three- or four-wire connections Cable resistance < 1 Ω (setting range in mΩ 0...9999)
Sensor break	Recognized

SITRANS TF280 WirelessHART

Displays and controls	
Display (with illumination)	
• Size of display	104 x 80 pixels
• Number of digits	Adjustable
• Number of spaces after comma	Adjustable
Setting options	• on site with 3 push buttons • with SIMATIC PDM or HART Communicator
Auxiliary power	
Battery	3.6 V DC
Communication	
Wireless standard	WirelessHART V7.1 conforming
Transmission frequency band	2.4 GHz (ISM-Band)
Range under reference conditions	Up to 250 m (line of sight) in outside areas Up to 50 m (greatly dependent on obstacles) in Inside areas
Communication interfaces	• HART communication with HART modem • WirelessHART
Certificates and approvals	
Wireless communication approvals	R&TTE, FCC
General Product Safety	$CSA_{US/C}$, CE, UL
Pressure equipment directive	This device is not included in the pressure device guideline; classification according to pressure device guideline (PED 97/23/EC), Directive 1/40; article 1, paragraph 2.1.4

1) Pre-mounted Pt100: Class A (maximum MES: 0.15 + 0.002*|t| °C)

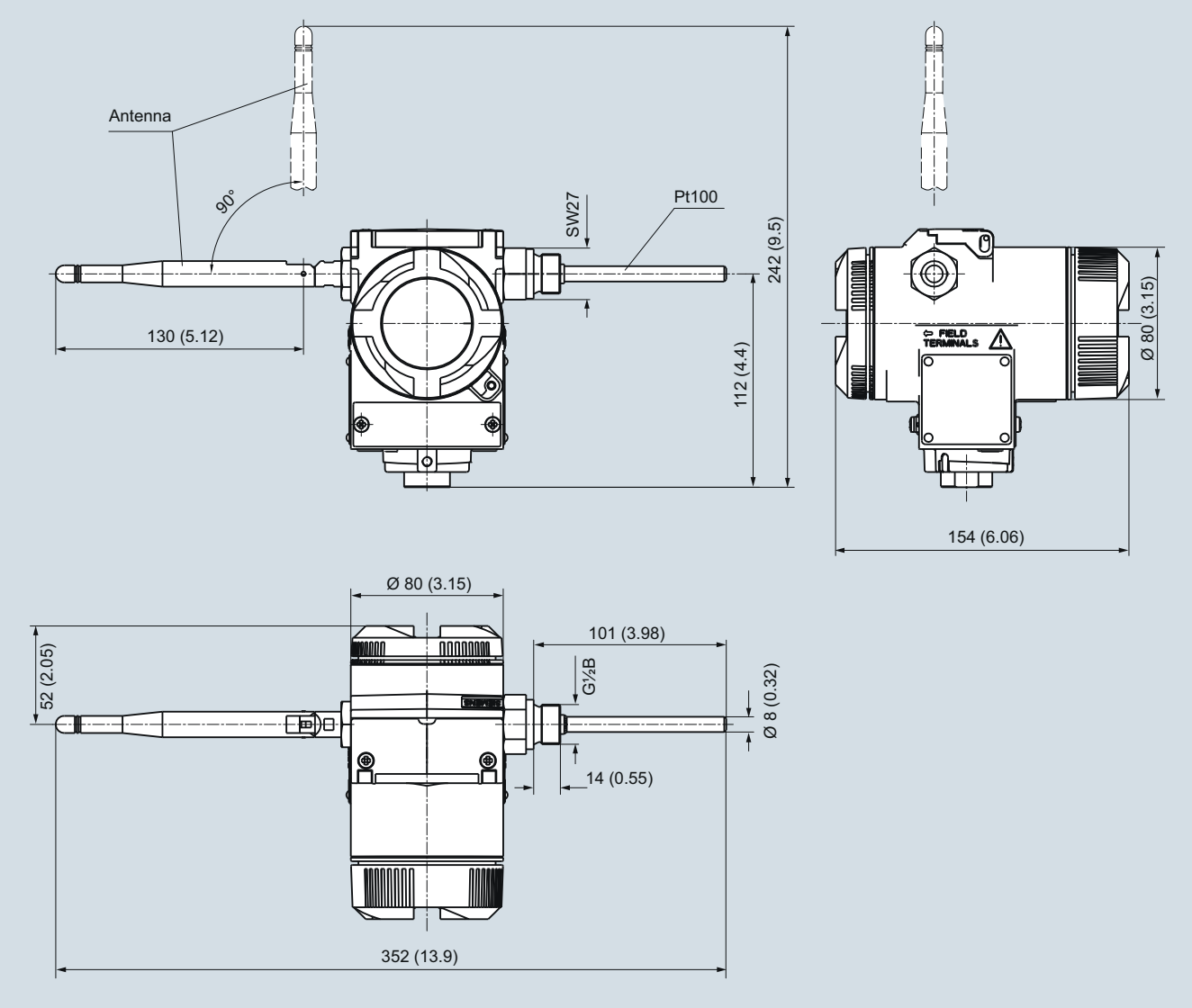
2) Calculation for errors:
Probable total error = $\sqrt{(MES^2 + AET^2 + LTD^2 + ATE^2)}$
Max. error = MES + AET + LTD + ATE
|t|: Absolut value of measured temperature
MES: Measurement error of sensor
AET: Accuracy error transmitter
LTD: Long term drift
ATE: Ambient temperature drift

Selection and Ordering data

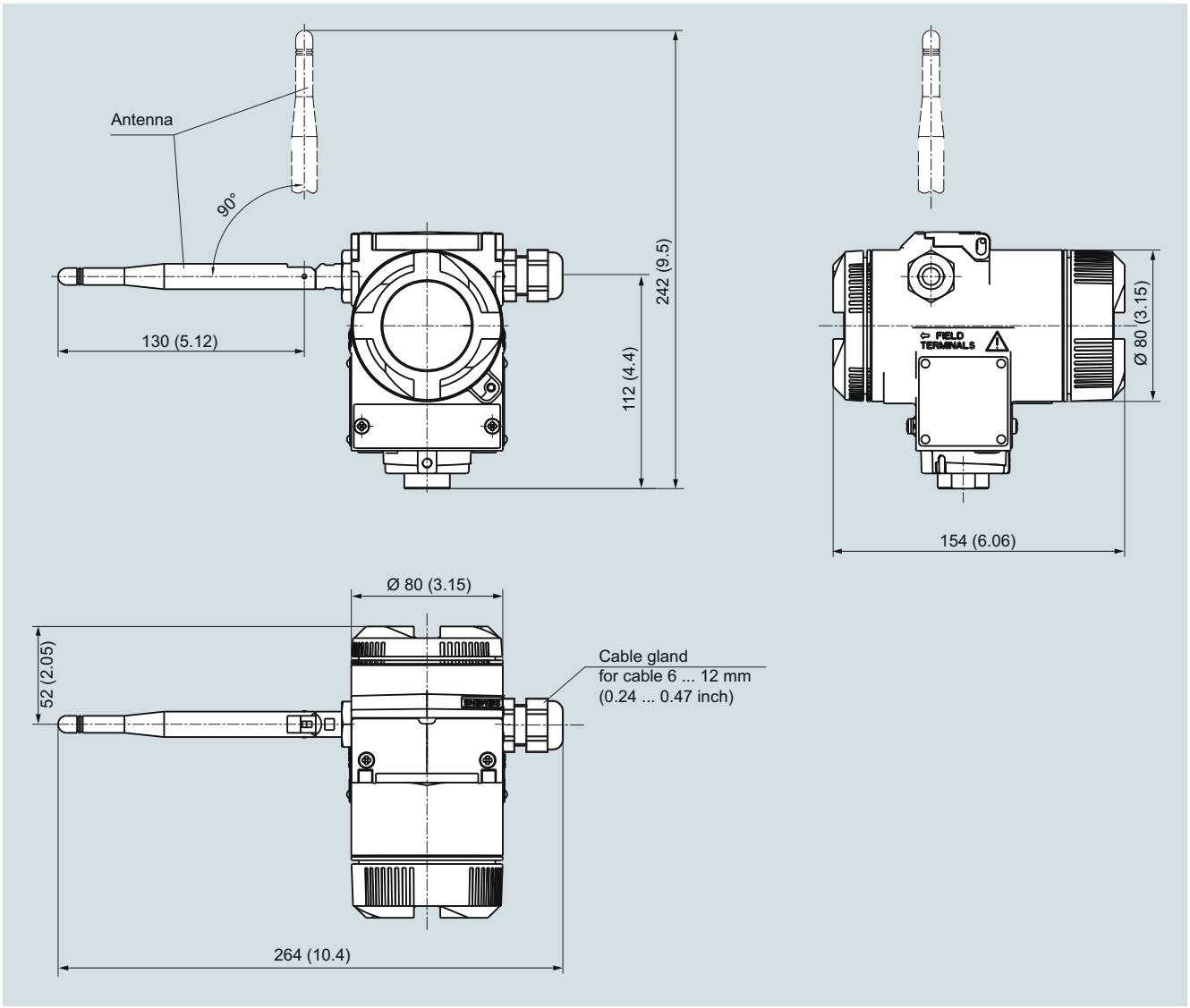
	Article No.
SITRANS TF280 WirelessHART Temperature transmitter ↗	**7MP1110-**
(Required battery not included with delivery, see accessories)	**0A■■■-0■■0**
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Connections/cable entry	
Cable gland M20x1.5 1)	**C**
Sensor pipe with Pt100, G½" male thread, pre-mounted and connected	**D**
Display	
Digital display, visible	**1**
Enclosure	
Die-cast aluminum	**1**
Explosion protection	
Not included	**A**
Antenna	
Variable, attached to device	**A**
Further designs	Order code
Please add "**-Z**" to Article No. and specify Order code(s) and plain text.	
Measuring point number (TAG Nr.) max. 16 digits entered in plain text Y15:	**Y15**
Measuring point message max. 27 characters entered in plain text: Y16:	**Y16**
Accessories	Article No.
Lithium battery for SITRANS TF280/P280	**7MP1990-0AA00**
Mounting bracket, steel	**7MF4997-1AC**
Mounting bracket, stainless steel	**7MF4997-1AJ**
Cover, die-cast aluminum, without window	**7MF4997-1BB**
Cover, die-cast aluminum, with window	**7MF4997-1BE**
Thread adapter M20x1.5 (male thread) on ½-14 NPT (female thread)	**7MP1990-0BA00**
Thread adapter M20x1.5 (male thread) on G½ (female thread)	**7MP1990-0BB00**
IE/WSN-PA Link	**See Sec. 7**
HART modem with USB interface	**7MF4997-1DB**
SIMATIC PDM	**See Sec. 8**

1) Please order sensor separately.

Dimensional drawings



SITRANS TF280 WirelessHART temperature transmitter with Pt100, dimensions in mm (inch).
Please see the dimensional drawing of the mounting bracket on page 1/171.



SITRANS TF280 WirelessHART temperature transmitter, dimensions in mm (inch)
Please see the dimensional drawing of the mounting bracket on page 1/171.

Overview

Our field devices for heavy industrial use

- HART, Universal
- 4 to 20 mA, universal
- Field indicator for 4 to 20 mA signals

The temperature transmitter SITRANS TF works where others feel uncomfortable.

Benefits

- Universal use
  - as transmitter for resistance thermometer, thermocouple element, Ω or mV signal
  - as field indicator for any 4 to 20 mA signals
- Local sensing of measured values over digital display
- Rugged two-chamber enclosure in die-cast aluminium or stainless steel
- Degree of protection IP67
- Test terminals for direct read-out of the output signal without breaking the current loop
- Can be mounted elsewhere if the measuring point
  - is hard to access,
  - is subject to high temperatures,
  - is subject to vibrations from the system,
  - or if you want to avoid long neck tubes and/or protective tubes.
- Can be mounted directly on American-design sensors
- Wide range of approvals for use in potentially explosive atmospheres. "Intrinsically safe, non-sparking and flameproof" type of protections, for Europe and USA.
- SIL2 (with Order Code C20), SIL2/3 (with C23)

Application

SITRANS TF can be used everywhere where temperatures need to be measured under particularly adverse conditions, or where a convenient local display is ideal. Which is why users from all industries have opted for this field device. The rugged enclosure protects the electronics. The stainless steel model is almost completely resistant to sea water and other aggressive elements. The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

Function

Configuration

The communication capability over the HART protocol V 5.9 of the SITRANS TF with an integrated SITRANS TH300 permits parameterization using a PC or HART communicator (hand-held communicator). The SIMATIC PDM makes it easy.

Parameterization is carried out using a PC for SITRANS TF with the integrated and programmable SITRANS TK. Available for this purpose are a special modem and the software tool SIPROM T.

Mode of operation

Mode of operation of SITRANS TF as temperature transmitter

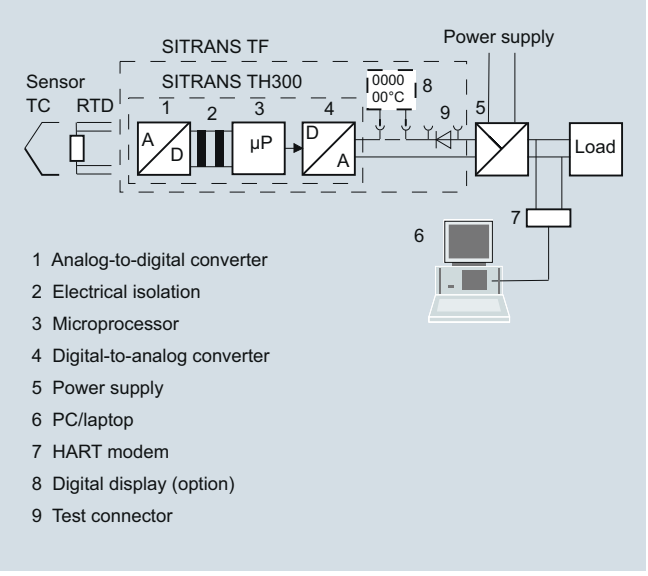
The sensor signal, whether resistance thermometer, thermocouple element or Ω or mV signal, is amplified and linearized. Sensor and output side are electrically isolated. An internal cold junction is integrated for measurements with thermocouple elements.

The device outputs a temperature-linear direct current of 4 to 20 mA. As well as the analog transmission of measured values from 4 to 20 mA, the HART version also supports digital communication for online diagnostics, measured value transmission and configuration.

SITRANS TF automatically detects when a sensor should be interrupted or is indicating a short-circuit. The practical test terminals allow direct measurement of 4 to 20 mA signals over an ammeter without interrupting the output current loop.

Mode of operation of SITRANS TF as field indicator

Any 4 to 20 mA signal can be applied to the generous terminal block. As well as a range of predefined measurement units, the adjustable indicator also supports the input of customized units. This means that any 4 to 20 mA signal can be represented as any type of unit, e.g. pressure, flow rate, filling level or temperature.



1 Analog-to-digital converter
2 Electrical isolation
3 Microprocessor
4 Digital-to-analog converter
5 Power supply
6 PC/laptop
7 HART modem
8 Digital display (option)
9 Test connector

Mode of operation: SITRANS TF with integrated transmitter and digital display

2

Technical specifications

Input	
Resistance thermometer	
Measured variable	Temperature
Sensor type	
• to IEC 60751	Pt25 … Pt1000
• to JIS C 1604; a=0.00392 K-1	Pt25 … Pt1000
• to IEC 60751	Ni25 … Ni1000
Units	°C and °F
Connection	
• Normal connection	1 resistance thermometer (RTD) in 2-wire, 3-wire or 4-wire system
• Generation of average value	Series or parallel connection of several resistance thermometers in a two-wire system for the generation of average temperatures or for adaptation to other device types
• Generation of difference	2 resistance thermometers (RTD) in 2-wire system (RTD 1 – RTD 2 or RTD 2 – RTD 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Always active (cannot be disabled)
Short-circuit monitoring	can be switched on/off (default value: ON)
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	10 °C (18 °F)
Characteristic curve	Temperature-linear or special characteristic
Resistance-based sensors	
Measured variable	Actual resistance
Sensor type	Resistance-based, potentiometers
Units	Ω
Connection	
• Normal connection	1 resistance-based sensor (R) in 2-wire, 3-wire or 4-wire system
• Generation of average value	2 resistance-based sensors in 2-wire system for generation of average value
• Generation of difference	2 resistance-based sensor in 2-wire system (R 1 – R 2 or R 2 – R 1)
Interface	
• Two-wire system	Parameterizable line resistance ≤ 100 Ω (loop resistance)
• Three-wire system	No balancing required
• Four-wire system	No balancing required
Sensor current	≤ 0.45 mA
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Short-circuit monitoring	Can be switched off (value is adjustable)
Measuring range	parameterizable max. 0 ... 2200 Ω (see table "Digital measuring errors")
Min. measured span	5 ... 25 Ω (see Table "Digital measuring errors")
Characteristic curve	Resistance-linear or special characteristic
Thermocouples	
Measured variable	Temperature
Sensor type (thermocouples)	
• Type B	Pt30Rh-Pt6Rh to DIN IEC 584
• Type C	W5 %-Re acc. to ASTM 988
• Type D	W3 %-Re acc. to ASTM 988
• Type E	NiCr-CuNi to DIN IEC 584
• Type J	Fe-CuNi to DIN IEC 584
• Type K	NiCr-Ni to DIN IEC 584
• Type L	Fe-CuNi to DIN 43710
• Type N	NiCrSi-NiSi to DIN IEC 584
• Type R	Pt13Rh-Pt to DIN IEC 584
• Type S	Pt10Rh-Pt to DIN IEC 584
• Type T	Cu-CuNi to DIN IEC 584
• Type U	Cu-CuNi to DIN 43710
Units	°C or °F
Connection	
• Normal connection	1 thermocouple (TC)
• Generation of average value	2 thermocouples (TC)
• Generation of difference	2 thermocouples (TC) (TC 1 – TC 2 or TC 2 – TC 1)
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Cold junction compensation	
• Internal	With integrated Pt100 resistance thermometer
• External	With external Pt100 IEC 60751 (2-wire or 3-wire connection)
• External fixed	Cold junction temperature can be set as fixed value
Measuring range	parameterizable (see table "Digital measuring errors")
Min. measured span	Min. 40 ... 100 °C (72 ... 180 °F) (see table "Digital measuring errors")
Characteristic curve	Temperature-linear or special characteristic
mV sensor	
Measured variable	DC voltage
Sensor type	DC voltage source (DC voltage source possible over an externally connected resistor)
Units	mV
Response time	≤ 250 ms for 1 sensor with open-circuit monitoring
Open-circuit monitoring	Can be switched off
Measuring range	-10 ... +70 mV -100 ... +1100 mV
Min. measured span	2 mV or 20 mV
Overload capability of the input	-1.5 ... +3.5 V DC
Input resistance	≥ 1 MΩ
Characteristic curve	Voltage-linear or special characteristic

Output	
Output signal	4 ... 20 mA, 2-wire
Communication with SITRANS TH300	acc. to HART Rev. 5.9
Digital display	
Digital display (optional)	In current loop
Display	Max. 5 digits
Digit height	9 mm (0.35 inch)
Display range	-99 999 ... + 99 999
Units	any (max. 5 char.)
Setting: Zero point, full-scale value and unit	with 3 buttons
Load voltage	2.1 V
Measuring accuracy	
Digital measuring errors	See table "Digital measuring errors"
Reference conditions	
• Auxiliary power	24 V ± 1 %
• Load	500 Ω
• Ambient temperature	23 °C (73.4 °F)
• Warming-up time	> 5 min
Error in the analog output (digital/analog converter)	< 0.025 % of span
Error due to internal cold junction	< 0.5 °C (0.9 °F)
Influence of ambient temperature	
• Analog measuring error	0.02 % of span/10 °C (18 °F)
• Digital measuring errors	
- with resistance thermometers	0.06 °C (0.11 °F)/10°C (18 °F)
- with thermocouples	0.6 °C (1.1 °F)/10°C (18 °F)
Auxiliary power effect	< 0.001 % of span/V
Effect of load impedance	< 0.002 % of span/100 Ω
Long-term drift	
• In the first month	< 0.02 % of span
• After one year	< 0.3 % of span
• After 5 years	< 0.4 % of span
Conditions of use	
Ambient conditions	
Storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Condensation	Permissible
Electromagnetic compatibility	According to EN 61326 and NAMUR NE21
Degree of protection to EN 60529	IP67
Construction	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure material	Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel, polyester-based lacquer, stainless steel rating plate
Electrical connection, sensor connection	Screw terminals, cable inlet via M20 x 1.5 or ½-14 NPT screwed gland
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel

Auxiliary power	
Without digital display	11 ... 35 V DC (30 V for Ex ib; 32 V for Ex ic and Ex nA)
With digital display	13.1 ... 5 V DC (30 V for Ex ib; 32 V for Ex ic and Ex nA)
Electrically isolated	Between input and output
• Test voltage	U_{eff} = 1 kV, 50 Hz, 1 min
Certificates and approvals	
Explosion protection ATEX	
• "Intrinsic safety" type of protection	with digital display: II 2 (1) G EEx ia IIC T4 without digital display: II 2 (1) G EEx ia IIC T6
- EC type test certificate	ZELM 11 ATEX 0471 X
• "Operating equipment that is non-ignitable and has limited energy for zone 2" type of protection	II 3G EEx nAL IIC T6/T4
- EC type test certificate	ZELM 11 ATEX 0471 X
• "Flame-proof enclosure" type of protection	II 2 G EEx d IIC T5/T6 II 1D Ex tD A20 IP65 T100 °C, T85 °C
- EC type test certificate	ZELM 11 ATEX 0472 X
Explosion protection to FM	Certificate of Compliance 3017742
• Identification (XP, DIP, NI, S)	• XP/I/1/BCD/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X • DIP/II, III/1/EFG/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X • NI/I/2/ABCD/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F) , Type 4X • S/II, III/2/FG/T5 Ta = 85 °C (185 °F), T6 Ta = 50 °C (112 °F), Type 4X
Other certificates	IECEx, GOST, INMETRO, NEPSI, KOSHA
Hardware and software requirements	
• For the parameterization software SIPROM T for SITRANS TF with TH200	
- Personal computer	PC with CD-ROM drive and USB
- PC operating system	Windows 98, NT, 2000, XP, 7 and Win 8
• For the parameterization software SIMATIC PDM for SITRANS TH300	See chapter 8 "Software", "SIMATIC PDM"
Communication	
Load for HART connection	230 ... 1100 Ω
• Two-core shielded	≤ 3.0 km (1.86 mi)
• Multi-core shielded	≤ 1.5 km (0.93 mi)
Protocol	HART protocol, version 5.9

Factory setting (transmitter):

- Pt100 (IEC 751) with 3-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Error signal in the event of sensor breakage: 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

2

Digital measuring errors

Resistance thermometer

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C)	(°F)	°C	(°F)
to IEC 60751					
Pt25	-200 ... +850 (-328 ... +1562)	10	(18)	0.3	(0.54)
Pt50	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +850 (-328 ... +1562)	10	(18)	0.1	(0.18)
Pt500	-200 ... +850 (-328 ... +1562)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
to JIS C1604-81					
Pt25	-200 ... +649 (-328 ... +1200)	10	(18)	0.3	(0.54)
Pt50	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt100 ... Pt200	-200 ... +649 (-328 ... +1200)	10	(18)	0.1	(0.18)
Pt500	-200 ... +649 (-328 ... +1200)	10	(18)	0.15	(0.27)
Pt1000	-200 ... +350 (-328 ... +662)	10	(18)	0.15	(0.27)
Ni 25 to Ni1000	-60 ... +250 (-76 ... +482)	10	(18)	0.1	(0.18)

Resistance-based sensors

Input	Measuring range	Min. measured span	Digital accuracy
	Ω	Ω	Ω
Resistance	0 ... 390	5	0.05
Resistance	0 ... 2200	25	0.25

Thermocouples

Input	Measuring range	Min. measured span		Digital accuracy	
	°C / (°F)	°C	(°F)	°C	(°F)
Type B	0 ... 1820 (32 ... 3308)	100	(180)	2[1]	(3.6)[1]
Type C (W5)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.8)[2]
Type D (W3)	0 ... 2300 (32 ... 4172)	100	(180)	1[2]	(1.8)[2]
Type E	-200 ... +1000 (-328 ... +1832)	50	(90)	1	(1.8)
Type J	-210 ... +1200 (-346 ... +2192)	50	(90)	1	(1.8)
Type K	-200 ... +1370 (-328 ... +2498)	50	(90)	1	(1.8)
Type L	-200 ... +900 (-328 ... +1652)	50	(90)	1	(1.8)
Type N	-200 ... +1300 (-328 ... +2372)	50	(90)	1	(1.8)
Type R	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type S	-50 ... +1760 (-58 ... +3200)	100	(180)	2	(3.6)
Type T	-20 ... +400 (-328 ... +752)	40	(72)	1	(1.8)
Type U	-200 ... +600 (-328 ... +1112)	50	(90)	2	(3.6)

[1] The digital accuracy in the range 0 to 300 °C (32 to 572 °F) is 3 °C (5.4 °F).

[2] The digital accuracy in the range 1750 to 2300 °C (3182 to 4172 °F) is 2 °C (3.6 °F).

mV sensor

Input	Measuring span	Min. measured span	Digital accuracy
	mV	mV	µV
mV sensor	-10 ... +70	2	40
mV sensor	-100 ... +1100	20	400

The digital accuracy is the accuracy after the analog/digital conversion including linearization and calculation of the measured value.

An additional error is generated in the output current 4 to 20 mA as a result of the digital/analog conversion of 0.025 % of the set span (digital-analog error).

The total error under reference conditions at the analog output is the sum from the digital error and the digital-analog error (poss. with the addition of cold junction errors in the case of thermocouple measurements).

Selection and Ordering data — Article No.

Temperature transmitter in field housing Two-wire system 4 ... 20 mA, with electrical isolation, with documentation on MiniDVD	↗	**7NG313**	■	-	■	■	■	■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.								
Integrated transmitter								
SITRANS TH200, programmable								
• Without Ex protection			**5**	**0**				
• With Ex ia			**5**	**1**				
• With Ex nAL for zone 2			**5**	**2**				
• Total device SITRANS TF Ex d[1)]			**5**	**4**				
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1)]			**5**	**5**				
SITRANS TH300, communication capability according to HART V 5.9								
• Without Ex-protection			**6**	**0**				
• With Ex ia			**6**	**1**				
• With Ex nAL for zone 2			**6**	**2**				
• Total device SITRANS TF Ex d[1)]			**6**	**4**				
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1)]			**6**	**5**				
Enclosure								
Die-cast aluminium					**A**			
Stainless steel precision casting					**E**			
Connections/cable inlet								
Screwed glands M20x1.5						**B**		
Screwed glands ½-14 NPT						**C**		
Digital indicator								
Without							**0**	
With							**1**	
Mounting bracket and securing parts								
Without								**0**
Made of steel								**1**
Made of stainless steel								**2**

Further designs Please add "**-Z**" to Article No. and specify Order code(s) and plain text.	Order code
Test protocol (5 measuring points)	**C11**
Functional safety SIL2	**C20**
Functional safety SIL2/3	**C23**
Explosion protection	
• Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....)	**E25**
• Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....)	**E26**
• Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2...)	**E27**
• Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1...)	**E55**
• Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....)	**E56**
• Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2...)	**E57**
• Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4...)	**E70**
• Two coats of lacquer on casing and cover (PU on epoxy)	**G10**
• Transient protection	**J01**
• Cable gland CAPRI 1/2 NPT ADE 4F, nickle-plated brass (CAPRI 848694 and 810634) included	**D57**
• Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included	**D58**
• Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included	**D59**
• Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	**D60**

Selection and Ordering data — Order Code

Customer-specific programming Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[2)]
Measuring point no. (TAG), max. 8 characters	**Y17**[3)]
Meas. point descriptor, max. 16 characters	**Y23**[4)]
Meas. point message, max. 32 characters	**Y24**[4)]
Only inscription on measuring point label: specify in plain text: Measuring range	**Y22**[4)]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[5)]
Pt100 (IEC) 3-wire	**U03**[5)]
Pt100 (IEC) 4-wire	**U04**[5)]
Thermocouple type B	**U20**[5)6)]
Thermocouple type C (W5)	**U21**[5)6)]
Thermocouple type D (W3)	**U22**[5)6)]
Thermocouple type E	**U23**[5)6)]
Thermocouple type J	**U24**[5)6)]
Thermocouple type K	**U25**[5)6)]
Thermocouple type L	**U26**[5)6)]
Thermocouple type N	**U27**[5)6)]
Thermocouple type R	**U28**[5)6)]
Thermocouple type S	**U29**[5)6)]
Thermocouple type T	**U30**[5)6)]
Thermocouple type U	**U31**[5)6)]
With TC: CJC external (Pt100, 3-wire)	**U41**
With TC: CJC external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[7)]
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**[3)]

Supply units see Chapter "Supplementary Components".

1) Without cable gland.
2) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.
3) For this selection, Y01 or Y09 must also be selected.
4) If only Y22, Y23 or Y24 are ordered and the label only has to be on the tag plate, Y01 does not have to be specified.
5) For this selection, Y01 must also be selected.
6) Internal cold junction compensation is selected as the default for TC.
7) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

SITRANS TF - Transmitter, two-wire system and SITRANS TF - Field indicator for 4 to 20 mA

Selection and Ordering data	Article No.
Accessories	
Modem for SITRANS TH100, TH200, TR200 and TF with TH200 incl. parameterization software T with USB interface	**7NG3092-8KU**
MiniDVD for temperature measuring instruments with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	**A5E00364512**
HART modem With USB interface	**7MF4997-1DB**
SIMATIC PDM parameterization software also for SITRANS TH300	**See chapter 8**
Mounting bracket and securing parts	
Made of steel for 7NG313.-..B..	**7MF4997-1AC**
Made of steel for 7NG313.-..C..	**7MF4997-1AB**
Made of stainless steel for 7NG313.-..B..	**7MF4997-1AJ**
Made of stainless steel for 7NG313.-..C..	**7MF4997-1AH**
Digital indicator[1)]	**7MF4997-1BS**
Connection board	**A5E02226423**

Supply units see Chapter "Supplementary Components".

1) It is not possible to upgrade devices with Ex protection

Ordering example 1:
7NG3135-0AB11-Z Y01+Y23+U03
Y01: -10 ... +100 °C
Y23: TICA1234HEAT

Ordering example 2:
7NG3136-0AC11-Z Y01+Y23+Y24+U25
Y01: -10 ... +100 °C
Y23: TICA 1234 ABC
Y24: HEATING BOILER 56789

Factory setting (transmitter):
- Pt100 (IEC 751) with three-wire circuit
- Measuring range: 0 ... 100 °C (32 ... 212 °F)
- Fault current 22.8 mA
- Sensor offset: 0 °C (0 °F)
- Damping 0.0 s

Selection and Ordering data	Article No.
SITRANS TF field indicator for 4 ... 20 mA signals, with documentation on MiniDVD	**7NG3130-**
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	
Without Ex-protection	**0** **1**
With Ex ia	**1** **1**
With Ex nAL for zone 2	**2** **1**
Total device SITRANS TF Ex d[1]	**4** **1**
Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	**5** **1**
Enclosure	
Die-cast aluminium	**A**
Stainless steel precision casting	**E**
Connections/cable inlet	
Screwed glands M20x1.5	**B**
Screwed glands ½-14 NPT	**C**
Digital indicator	
With	**1**
Mounting bracket and securing parts	
Without	**0**
Made of steel	**1**
Made of stainless steel	**2**
Further designs Please add "**-Z**" to Article No. and specify Order code(s) and plain text.	Order code
Test protocol (5 measuring points)	**C11**
Explosion protection	
• Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....)	**E25**
• Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....)	**E26**
• Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2...)	**E27**
• Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1...)	**E55**
• Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....)	**E56**
• Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2...)	**E57**
• Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4...)	**E70**
• Two coats of lacquer on casing and cover (PU on epoxy)	**G10**
• Transient protection	**J01**
• Cable gland CAPRI 1/2 NPT ADE 4F, nickle-plated brass (CAPRI 848694 and 810634) included	**D57**
• Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included	**D58**
• Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included	**D59**
• Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	**D60**

Selection and Ordering data	Order Code
Customer-specific programming Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[2]
Only inscription on TAG plate: specify in plain text: Measuring range	**Y22**[3]
Only inscription on TAG plate: Measuring point descriptor, max. 16 characters	**Y23**[3]
Only inscription on TAG plate: Measuring point message, max. 27 characters	**Y24**[3]
Special differing customer-specific programming, specify in plain text	**Y09**[4]

Supply units see Chapter "Supplementary Components".

1) Without cable gland.

2) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

3) If only Y22, Y23 or Y24 are ordered and the label only has to be on the tag plate, Y01 does not have to be specified.

4) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Selection and Ordering data	Article No.
Accessories	
MiniDVD for temperature measuring instruments with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	**A5E00364512**
Mounting bracket and securing parts	
Made of steel for 7NG313.-..B..	**7MF4997-1AC**
Made of steel for 7NG313.-..C..	**7MF4997-1AB**
Made of stainless steel for 7NG313.-..B..	**7MF4997-1AJ**
Made of stainless steel for 7NG313.-..C..	**7MF4997-1AH**
Digital indicator[1]	**7MF4997-1BS**
Connection board	**A5E02226423**

1) It is not possible to upgrade devices with Ex protection

Ordering example 1:

7NG3130-0AB10-Z Y01+Y23
Y01: -5...100 °C
Y23: TICA1234HEAT

Ordering example 2:

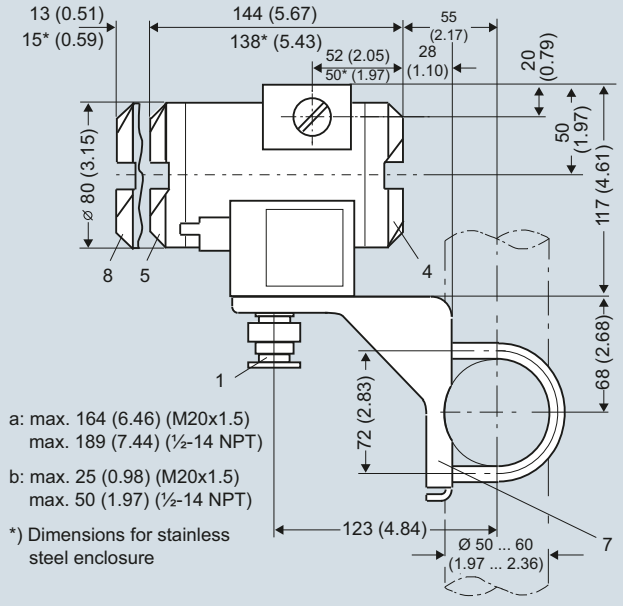
7NG3130-0AC10-Z Y01+Y23+Y24
Y01: 0 ... 20 BAR
Y23: PICA 1234 ABC
Y29: HEATING BOILER 67890

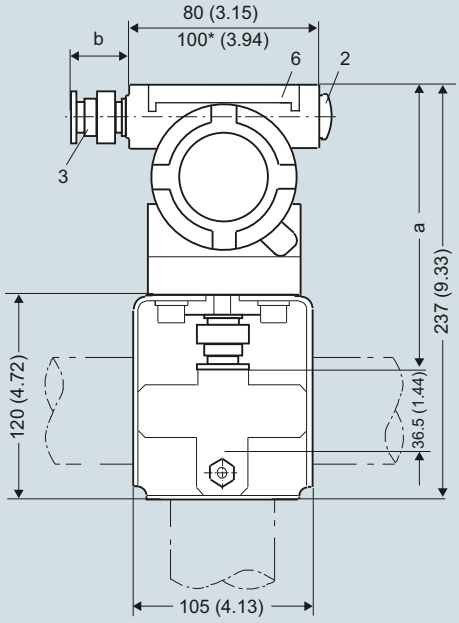
Factory setting (field indicator):

4 ... 20 mA

2

Dimensional drawings





1 Sensor connection (screwed gland M20x1.5 or ½-14 NPT)

2 Blanking plug

3 Electrical connection (screwed gland M20x1.5 or ½-14 NPT)

4 Terminal side, output signal

5 Terminal side, sensor

6 Protective cover (without function)

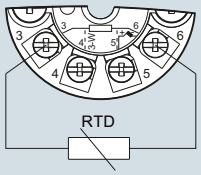
7 Mounting bracket (option) with clamp for securing to a vertical or horizontal pipe

8 Cover with window for digital display

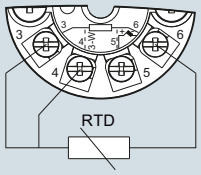
SITRANS TF, dimensions in mm (inches)

Schematics

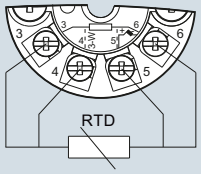
Resistance thermometer



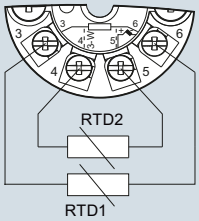
Two-wire system [1)]



Three-wire system

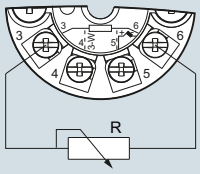


Four-wire system

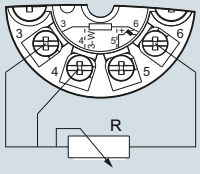


Generation of average value / difference [1)]

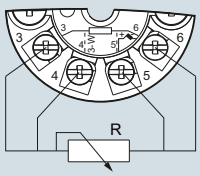
Resistance



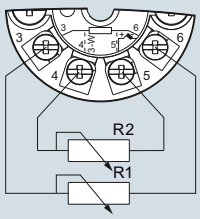
Two-wire system [1)]



Three-wire system

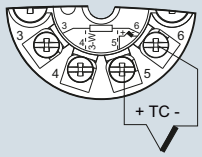


Four-wire system

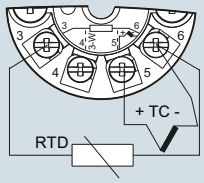


Generation of average value / difference [1)]

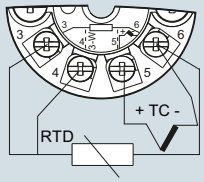
Thermocouple



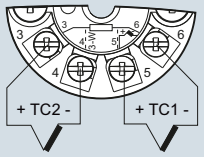
Cold junction compensation
Internal/fixed value



Cold junction compensation with external Pt100 in two-wire system [1)]



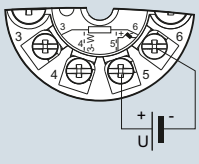
Cold junction compensation with external Pt100 in three-wire system



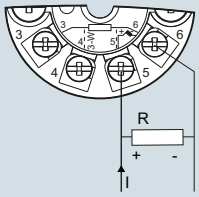
Generation of average value / difference with internal cold junction compensation

[1)] Programmable line resistance for the purpose of correction.

Voltage measurement



Current measurement



SITRANS TF, sensor connection assignment

SITRANS TF fieldbus transmitter

2

Overview

Our field devices for heavy industrial use

- FOUNDATION fieldbus
- PROFIBUS PA

The SITRANS TF temperature transmitter works where others can't cope.

Benefits

- For universal use as a transmitter for resistance thermometers, thermocouple elements, Ω or mV signals
- Rugged two-chamber enclosure in die-cast aluminium or stainless steel
- Degree of protection IP67
- Can be mounted elsewhere if the measuring point
  - is hard to access,
  - is subject to high temperatures,
  - is subject to vibrations from the system,
  - or if you want to avoid long neck tubes and/or protective tubes.
- Can be mounted directly on American-design sensors
- Wide range of approvals for use in potentially explosive atmospheres. "Intrinsically safe, non-sparking and flameproof" type of protection, for Europe and USA

Application

The SITRANS TF can be used everywhere where temperatures need to be measured under particularly harsh conditions. Which is why users from all industries have opted for this field device.

The rugged enclosure protects the electronics. The stainless steel model is almost completely resistant to sea water and other aggressive elements.

The inner workings offer high measuring accuracy, universal input and a wide range of diagnostic options.

Function

Features

- Polarity-neutral bus connection
- 24-bit analog-digital converter for high resolution
- Electrically isolated
- Version for use in hazardous areas
- Special characteristic
- Sensor redundance

Transmitter with PROFIBUS PA communication

- Function blocks: 2 x analog

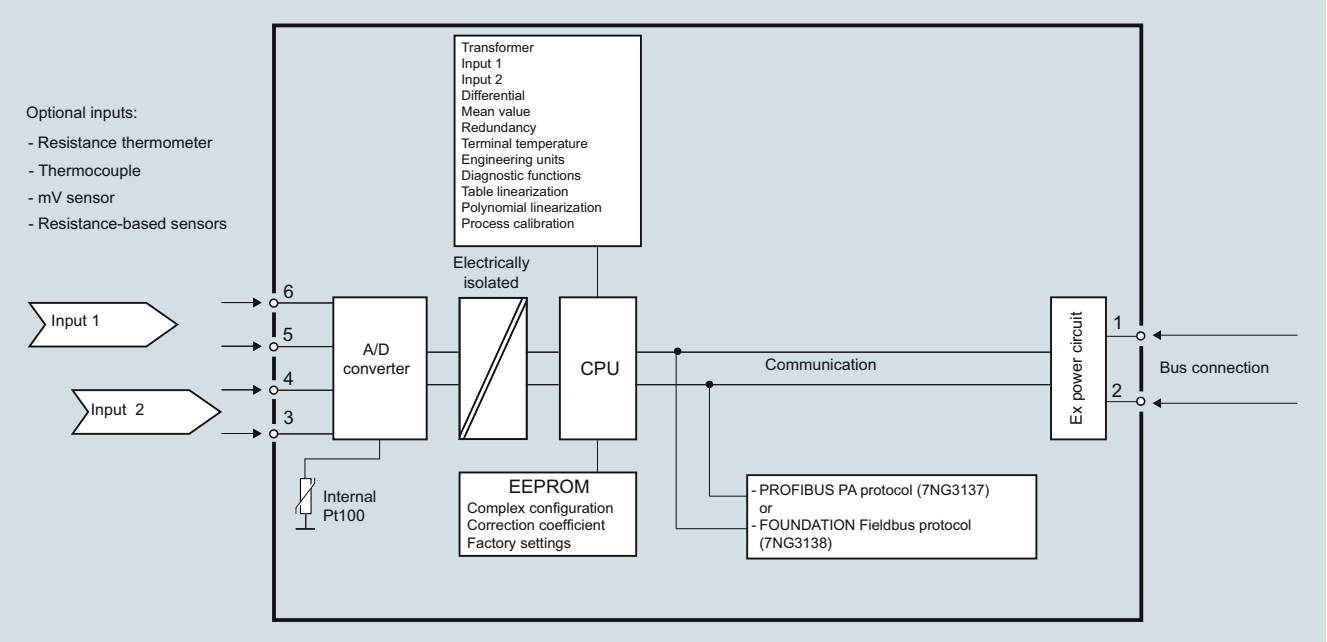
Transmitter with FOUNDATION fieldbus communication

- Function blocks: 2 x analog and 1 x PID
- Functionality: Basic or LAS

Mode of operation

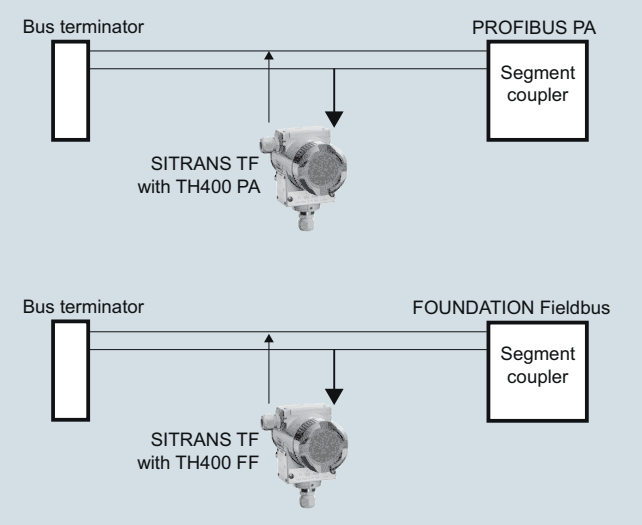
The following function diagram explains the mode of operation of the transmitter.

The only difference between the two versions of the SITRANS TF (7NG3137-... and 7NG3138-...) is the type of field bus protocol used (PROFIBUS PA or FOUNDATION fieldbus).



SITRANS TF with TH400, function diagram

System communication



SITRANS TF with TH400, communication interface

Technical specifications

Input	
Analog/digital conversion	
• Measurement rate	< 50 ms
• Resolution	24-bit
Resistance thermometer	
Pt25 ... 1000 to IEC 60751/JIS C 1604	
• Measuring range	-200 ... +850 °C (-328 ... +1562 °F)
Ni25 ... 1000 to DIN 43760	
• Measuring range	-60 ... +250 °C (-76 ... +482 °F)
Cu10 ... 1000, α = 0.00427	
• Measuring range	-50 ... +200 °C (-58 ... +392 °F)
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Resistance-based sensors	
Measuring range	0 ... 10 kΩ
Line resistance per sensor cable	Max. 50 Ω
Sensor current	Nominal 0.2 mA
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 15 Ω
Thermocouple	
to IEC 584	Measuring range
• Type B	400 ... 1820 °C (752 ... 3308 °F)
• Type E	-100 ... +1000 °C (-148 ... +1832 °F)
• Type J	-100 ... +1000 °C (-148 ... +1832 °F)
• Type K	-100 ... +1200 °C (-148 ... +2192 °F)
• Type N	-180 ... +1300 °C (-292 ... +2372 °F)
• Type R	-50 ... +1760 °C (-58 ... +3200 °F)
• Type S	-50 ... +1760 °C (-58 ... +3200 °F)
• Type T	-200 ... +400 °C (-328 ... +752 °F)
to DIN 43710	
• Type L	-200 ... +900 °C (-328 ... +1652 °F)
• Type U	-200 ... +600 °C (-328 ... +1112 °F)
to ASTM E988-90	
• Type W3	0 ... 2300 °C (32 ... 4172 °F)
• Type W5	0 ... 2300 °C (32 ... 4172 °F)
External cold junction compensation	-40 ... +135 °C (-40 ... +275 °F)
Sensor fault detection	
• Sensor break detection	Yes
• Sensor short-circuit detection	Yes, < 3 mV
• Sensor current in the event of open-circuit monitoring	4 µA
mV sensor - voltage input	
Measuring range	-800 ... +800 mV
Input resistance	10 MΩ
Output	
Filter time (programmable)	0 ... 60 s
Update time	< 400 ms
Measuring accuracy	
Accuracy is defined as the higher value of general values and basic values.	

General values

Type of input	Absolute accuracy	Temperature coefficient
All	≤ ± 0.05 % of the measured value	≤ ± 0.002 % of the measured value/°C

Basic values

Type of input	Basic accuracy	Temperature coefficient
Pt100 and Pt1000	≤ ± 0.1 °C	≤ ± 0.002 °C/°C
Ni100	≤ ± 0.15 °C	≤ ± 0.002 °C/°C
Cu10	≤ ± 1.3 °C	≤ ± 0.02 °C/°C
Resistance-based sensors	≤ ± 0.05 Ω	≤ ± 0.002 Ω/°C
Voltage source	≤ ± 10 µV	≤ ± 0.2 µV/°C
Thermocouple, type: E, J, K, L, N, T, U	≤ ± 0.5 °C	≤ ± 0.01 °C/°C
Thermocouple, type: B, R, S, W3, W5	≤ ± 1 °C	≤ ± 0.025 °C/°C
Cold junction compensation	≤ ± 0.5 °C	

Reference conditions	
Warming-up time	30 s
Signal-to-noise ratio	Min. 60 dB
Calibration condition	20 ... 28 °C (68 ... 82 °F)

SITRANS TF fieldbus transmitter

Conditions of use	
Ambient conditions	
Permissible ambient temperature	-40 ... +85 °C (-40 ... +185 °F)
Permissible storage temperature	-40 ... +85 °C (-40 ... +185 °F)
Relative humidity	≤ 98 %, with condensation
Insulation resistance	
• Test voltage	500 V AC for 60 s
• Continuous operation	50 V AC/75 V DC
Electromagnetic compatibility	
NAMUR	NE21
EMC 2004/108/EC Emission and Noise Immunity	EN 61326-1, EN 61326-2-5
Construction	
Weight	Approx. 1.5 kg (3.3 lb) without options
Dimensions	See "Dimensional drawings"
Enclosure materials	• Die-cast aluminum, low in copper, GD-AlSi 12 or stainless steel • Polyester-based lacquer for GD AlSi 12 enclosure • Stainless steel rating plate
Electrical connection, sensor connection	• screw terminals • Cable inlet via M20 x 1.5 or ½ -14 NPT screwed gland • Bus connection with M12 plug (optional)
Mounting bracket (optional)	Steel, galvanized and chrome-plated or stainless steel
Degree of protection	IP67 to EN 60529
Auxiliary power	
Power supply	
• Standard, Ex "d", Ex "nA", Ex "nL", XP, NI	10.0 ... 32 V DC
• Ex "ia", Ex "ib"	10.0 ... 30 V DC
• In FISCO/FNICO installations	10.0 ... 17.5 V DC
Power consumption	< 11 mA
Max. increase in power consumption in the event of a fault	< 7 mA
Certificates and approvals	
Explosion protection ATEX	
EC type test certificate	ZELM 11 ATEX 0471 X
• Type of protection "intrinsic safety i" (version: 7NG313x-1xxxx)	II 2(1) G Ex ia IIC T4/T6
Conformity statement	ZELM 11 ATEX 0471 X
• "Operating equipment that is non-ignitable and has limited energy" type of protection (version: 7NG313x-2xxxx)	II 3 G Ex nA [nL] IIC T4/T6 II 3 G Ex nL IIC T4/T6
EC type test certificate	ZELM 11 ATEX 0472 X
• "Flame-proof enclosure" type of protection (version: 7NG313x-4xxxx)	II 2 G Ex d IIC T5/T6 II 1D Ex tD A20 IP65 T100 °C, T85 °C
Explosion protection: FM for USA	
• FM approval	FM 3017742
• Type of protection XP, DIP, NI and S (version 7NG313x-5xxxx)	• XP / I / 1 / BCD / T5,T6; Type 4X • DIP / II, III / 1 / EFG / T5,T6; Type 4X • NI / I / 2 / ABCD / T5,T6; Type 4X • S / II, III / 2 / FG T5,T6; Type 4X
Other certificates	GOST, INMETRO, NEPSI, KOSHA

Communication	
Parameterization interface	
• PROFIBUS PA connection	
- Protocol	A&D profile, Version 3.0
- Protocol	EN 50170 Volume 2
- Address (for delivery)	126
- Function blocks	2 x analog
• FOUNDATION fieldbus connection	
- Protocol	FF protocol
- Protocol	FF design specifications
- Functionality	Basic or LAS
- Version	ITK 4.6
- Function blocks	2 x analog and 1 x PID
Factory setting	
for SITRANS TH400 PA	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
PA address	126
PROFIBUS Ident No.	Manufacturer-specific
for SITRANS TH400 FF	
Sensor	Pt100 (IEC)
Type of connection	3-wire circuit
Unit	°C
Failure mode	Last valid value
Filter time	0 s
Node address	22

Selection and Ordering data	Article No.
Temperature transmitter in field enclosure ↗ with fieldbus communication and electrical isolation, with documentation on MiniDVD ↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.	**7 N G 3 1 3 ■ - ■ ■ ■ 0 ■**
Integrated transmitter	
SITRANS TH400 with PROFIBUS PA	
• Without Ex protection	**7 0**
• With Ex ia (ATEX)	**7 1**
• With Ex nAL for zone 2 (ATEX)	**7 2**
• Total device SITRANS TF Ex d[1]	**7 4**
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	**7 5**
SITRANS TH400, with FOUNDATION fieldbus	
• Without Ex protection	**8 0**
• With Ex ia (ATEX)	**8 1**
• With Ex nAL for zone 2 (ATEX)	**8 2**
• Total device SITRANS TF Ex d[1]	**8 4**
• Total device SITRANS TF according to FM (XP, DIP, NI, S)[1]	**8 5**
Enclosure	
Die-cast aluminium	**A**
Stainless steel precision casting	**E**
Connections/cable inlet	
Screwed glands M20x1.5	**B**
Screwed gland s ½-14 NPT	**C**
Mounting bracket and fastening parts	
None	**0**
Made of steel	**1**
Stainless steel	**2**
Further designs Please add "**-Z**" to Article No. and specify Order code(s) and plain text.	Order code
Test report (5 measuring points)	**C11**
Bus connection	
• M12 plug (metal), without mating connector	**M00**[2]
• M12 plug (metal), with mating connector	**M01**[2]
Explosion protection	
• Explosion protection Ex ia to INMETRO (Brazil) (only with 7NG313.-1....)	**E25**
• Explosion protection Ex d to INMETRO (Brazil) (only with 7NG313.-4....)	**E26**
• Explosion protection Ex nA to INMETRO (Brazil) (only with 7NG313.-2...)	**E27**
• Explosion protection Ex i to NEPSI (China) (only with 7NG313.-1...)	**E55**
• Explosion protection Ex d to NEPSI (China) (only with 7NG313.-4....)	**E56**
• Explosion protection Ex nA to NEPSI (China) (only with 7NG313.-2...)	**E57**
• Explosion protection Ex d to KOSHA (Korea) (only with 7NG313.-4...)	**E70**
• Two coats of lacquer on casing and cover (PU on epoxy)	**G10**
• Transient protection	**J01**
• Cable gland CAPRI 1/2 NPT ADE 4F, nickle-plated brass (CAPRI 848694 and 810634) included	**D57**
• Cable gland 1/2 NPT ADE 1F, cable diam. 6 ... 12 (CAPRI 818694 and 810534) included	**D58**
• Cable gland 1/2 NPT ADE 4F, stainless steel (CAPRI 848699 and 810634) included	**D59**
• Cable gland 1/2 NPT ADE 1F, cable diam. 4 ... 8.5 (CAPRI 818674 and 810534) included	**D60**

Selection and Ordering data	Order Code.
Customer-specific programming Add "**-Z**" to Article No. and specify Order code(s)	
Measuring range to be set Specify in plain text (max. 5 digits): Y01: ... to ... °C, °F	**Y01**[3]
Meas. point no. (TAG), max. 32 characters	**Y15**[4]
Meas. point descriptor, max. 32 characters	**Y23**[4]
Meas. point message, max. 32 characters	**Y24**[5]
Bus address, specify in plain text	**Y25**[4]
Pt100 (IEC) 2-wire, R_L = 0 Ω	**U02**[6]
Pt100 (IEC) 3-wire	**U03**[6]
Pt100 (IEC) 4-wire	**U04**[6]
Thermocouple type B	**U20**[6][7]
Thermocouple type C (W5)	**U21**[6][7]
Thermocouple type D (W3)	**U22**[6][7]
Thermocouple type E	**U23**[6][7]
Thermocouple type J	**U24**[6][7]
Thermocouple type K	**U25**[6][7]
Thermocouple type L	**U26**[6][7]
Thermocouple type N	**U27**[6][7]
Thermocouple type R	**U28**[6][7]
Thermocouple type S	**U29**[6][7]
Thermocouple type T	**U30**[6][7]
Thermocouple type U	**U31**[6][7]
With TC: CJC: external (Pt100, 3-wire)	**U41**
With TC: CJC: external with fixed value, specify in plain text	**Y50**
Special differing customer-specific programming, specify in plain text	**Y09**[8]

1) Without cable gland

2) Not available for explosion protection Ex d or XP.

3) For customer-specific programming for RTD and TC, the start value and the end value of the required measuring span must be specified here.

4) If only Y15, Y23 or Y25 are ordered and the label only has to be on the tag plate, Y01 does not have to be specified.

5) For this selection, Y01 or Y09 must also be selected.

6) For this selection, Y01 must also be selected.

7) Internal cold junction compensation is selected as the default for TC.

8) For customer-specific programming, for example mV and ohm, the start value and the end value of the required measuring span and the unit must be entered here.

Selection and Ordering data	Article No.
Accessories	
MiniDVD for temperature measuring instruments with documentation in German, English, French, Spanish, Italian and Portuguese, and parameterization software SIPROM T (included in delivery with SITRANS TF)	**A5E00364512**
SIMATIC PDM parameterization software also for SITRANS TF with TH400 PA	**See Sec. 8**
Mounting bracket and fastening parts	
Made of steel for 7NG313.-..B..	**7MF4997-1AC**
Made of steel for 7NG313.-..C..	**7MF4997-1AB**
Made of stainless steel for 7NG313.-..B..	**7MF4997-1AJ**
Made of stainless steel for 7NG313.-..C..	**7MF4997-1AH**
Connection board	**A5E02391790**

Ordering example 1:

7NG3137-0AB01-Z Y01+Y15+Y25+U03
Y01: -10 ... +100 °C
Y15: TICA1234HEAT
Y25: 33

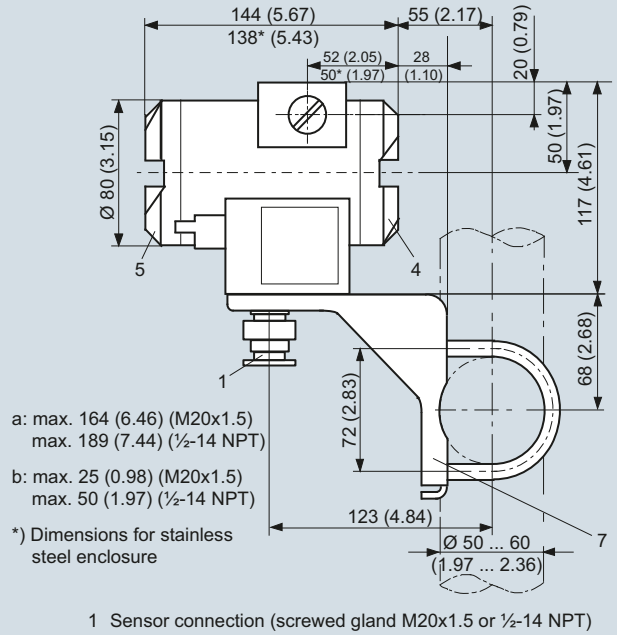
Ordering example 2:

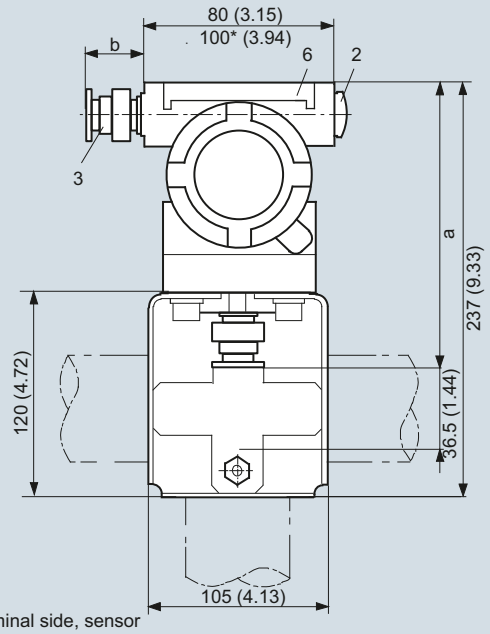
7NG3137-0AC01-Z Y01+Y15+Y25+U25
Y01: -10 ... +100 °C
Y15: TICA 1234 ABC 5678
Y25: 35

Factory setting:

- for SITRANS TH400 PA:
  - Pt100 (IEC) with 3-wire circuit
  - Unit: °C
  - Failure mode: last valid value
  - Filter time: 0 s
  - PA address: 126
  - PROFIBUS Ident No.: manufacturer-specific
- for SITRANS TH400 FF:
  - Pt100 (IEC) with 3-wire circuit
  - Unit: °C
  - Failure mode: last valid value
  - Filter time: 0 s
  - Node address: 22

Dimensional drawings





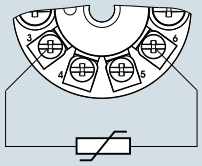
1 Sensor connection (screwed gland M20x1.5 or ½-14 NPT)
2 Blanking plug
3 Electrical connection (screwed plug M20x1.5 orr ½-14 NPT), optional M12 plug
4 Terminal side, bus connection
5 Terminal side, sensor
6 Protective cover (without function)
7 Mounting bracket (optional) with clamp securing to a vertical or horizontal pipe

SITRANS TF with TH400, dimensions in mm (inches)

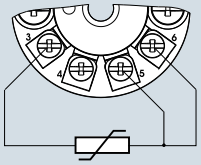
2

Schematics

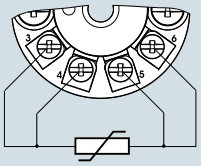
Resistance thermometer



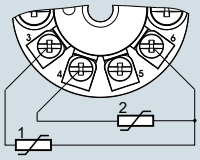
Two-wire system [1)]



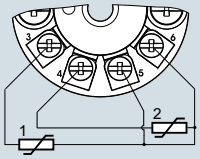
Three-wire system



Four-wire system

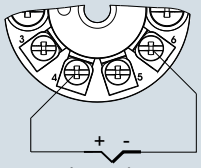


Mean-value/differential or redundancy generation
2 x two-wire system [1)]

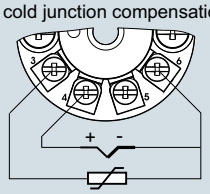


Mean-value/differential or redundancy generation
1 sensor in two-wire system [1)]
1 sensor in three-wire system

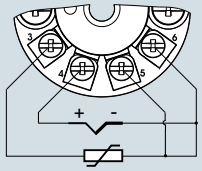
Thermocouple



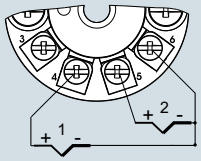
Internal
cold junction compensation



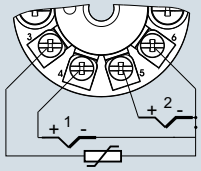
Cold junction compensation
with external Pt100 in two-wire system [1)]



Cold junction compensation
with external Pt100 in three-wire system

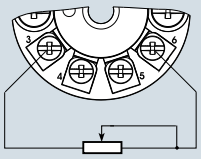


Mean value, differential or redundancy generation with internal cold junction compensation

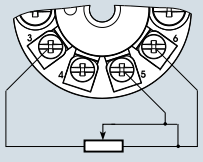


Mean value, differential or redundancy generation and cold junction compensation with internal Pt100
in two-wire system [1)]

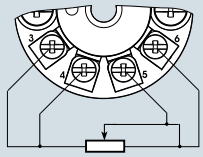
Resistance



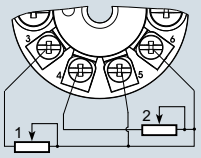
Two-wire system [1)]



Three-wire system

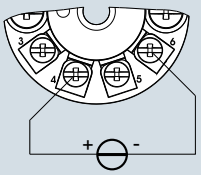


Four-wire system

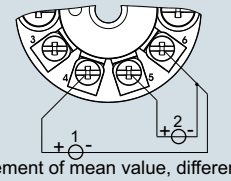


Mean value, differential or redundancy generation
1 resistor in two-wire system [1)]
1 resistor in three-wire system

Voltage measurement



One voltage source



Measurement of mean value, differential and redundancy with 2 voltage sources

[1)] Programmable line resistance for the purpose of correction.

SITRANS TF with TH400, sensor connection assignment

Overview

Temperature sensors of the SITRANS TS500 product family are used to measure temperatures in industrial equipment.

Benefits

The modular design makes it possible to customize the temperature sensor for most applications, while still being able to use many standardized individual components.

SITRANS TS500 Temperature sensors as a modular system

Due to their modular design, temperature sensors of the SITRANS TS500 series are well suited to a large number of applications.

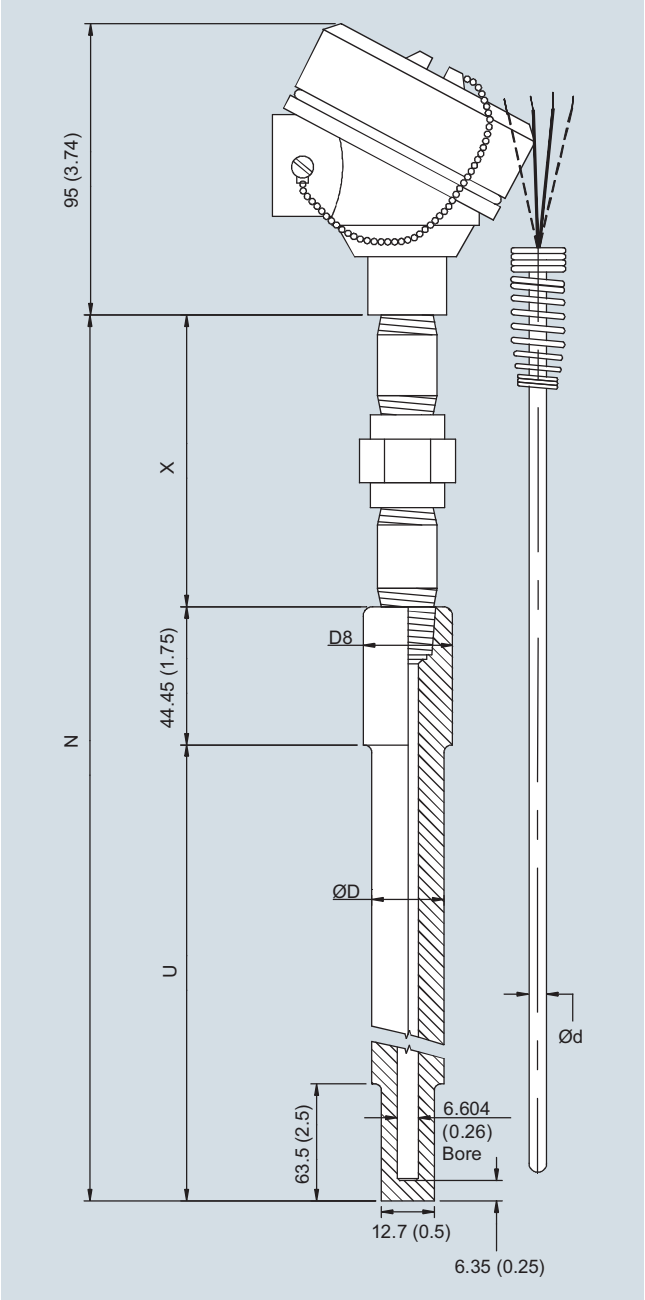
The replaceable measuring insert makes it possible to conduct maintenance work even during ongoing operations. These devices are used particularly frequently in vessels and pipelines of the following industries:

- Power plants
- Chemical industry
- Petrochemical industry
- General process engineering
- Water, waste water

2

Design

SITRANS TS500 7MC65xx



SITRANS TS500, type SWR, socket reduced well, dimensions in mm (inch)

The temperature sensors of the SITRANS TS500 series are available in four different designs:

- General Purpose without Thermowell
- Threaded Thermowell
- Flanged Thermowell
- Socket Thermowell

Function

A complete measuring point consists of a measuring insert which contains the basic sensors, the protective fitting and an optional transmitter.

The basic sensors are:

- Resistance thermometers:
  Temperature measurement is based on the temperature dependency of the installed measuring resistor.
- Thermocouples:
  Temperature measurement is based on the Seebeck effect. A thermocouple which subjected to a temperature drop produces thermoelectric voltage that can be measured.

Transmitters:

The optional Siemens transmitters assume the following functions:

- Optimum measurement processing
- Strengthening of weak sensor signals directly on site
- Transmits standardized signals
- Protects against electromagnetic interfrences
- Support enhanced diagnosis options

The resistance thermometer is intended for installation in containers and pipelines.

- Modular design consisting of protective pipe, measuring insert, connection head and optional transmitter for replacement during operation.
- Transmitter can be integrated (4 to 20 mA, PROFIBUS PA or FOUNDATION Fieldbus)

Configuration

Components: Process connections

Flanges

The different properties of the flanges are as follows:

- Standard series EN 1092, ASME 16.5,..
- Nominal pressure
- Nominal diameter
- Sealing face

This information is stamped into the flange, as well as the material code and batch number for "3.1 Material".

Components: Thermowell

Thermowells fulfill two basic functions:

- They protect the measuring insert from aggressive media
- They make it possible to replace units during ongoing operations

This catalog is limited to the standard versions. Special versions are available on request. The large number of available types can be classified as follows:

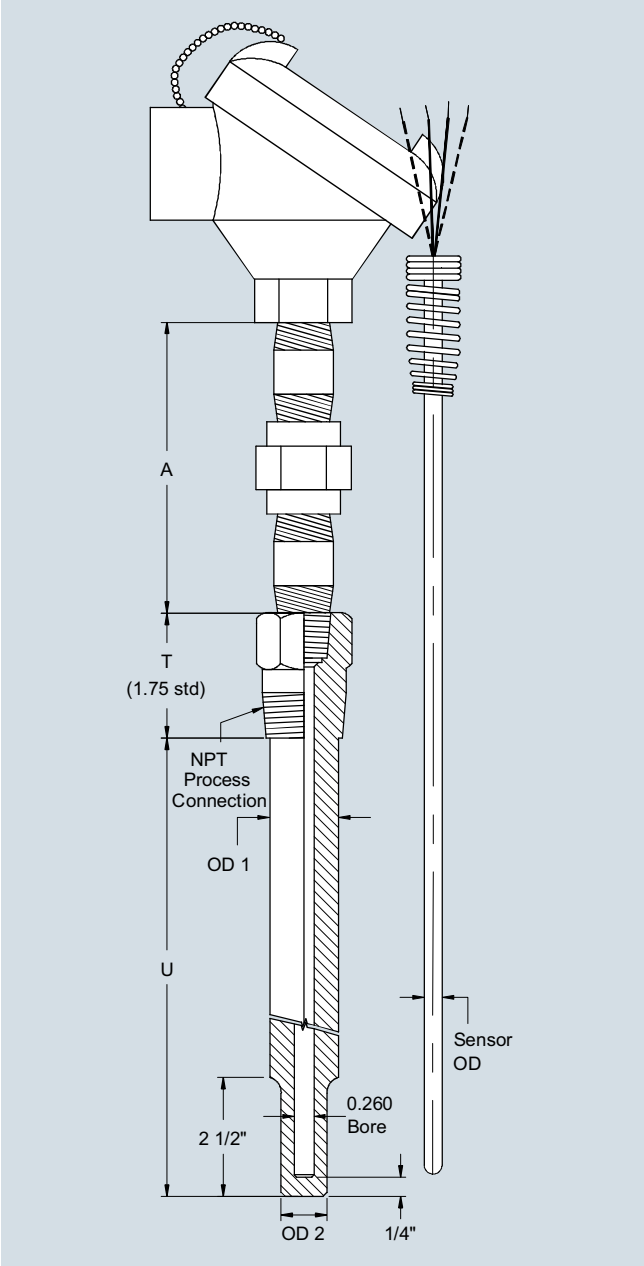
- Barstock thermowells
  Where process loads are too high, or where thermowells with welded seams are not allowed, deep hole drilled barstock thermowells are used. Form 4 thermowells (as per DIN 43772) are very popular in this area. This thermowell type replaces the D1-D5 types of the predecessor standard DIN 43763.

Components: Extension (neck tube)

The extension is the section from the lower edge of the connection head to the fixed point of the process connection or thermowell. There is a variety of terms for this components, e.g. neck tube. For this reason the term extension has been selected as a standardized term for the different designs. Function is the deciding factor:

- Thermal decoupling of connection head from process temperature see image page 2/87
- Installation of connection head over existing insulation
- Simple standardization of measuring inserts: In general, the length of the extension may be freely selected. However, when using standardized insertion lengths, the option "Extension as per DIN 43 772" is recommended. This ensures that measuring inserts which are quickly available can be used. In case of special lengths, it is possible to standardize the measuring insert length through a clever combination with the respective special extension length. This allows customers to optimize their costs in purchasing and logistics.
- In the case of American-designed sensors, the extension also takes the spring load of the measuring unit.
- Depending on the design, the extension can also be used to achieve an alignment of the connection head.
- Barstock thermowells:
  Extension and thermowell of two components which are welded together. The process connection is attached to the thermowell (= multi-piece protective armature).

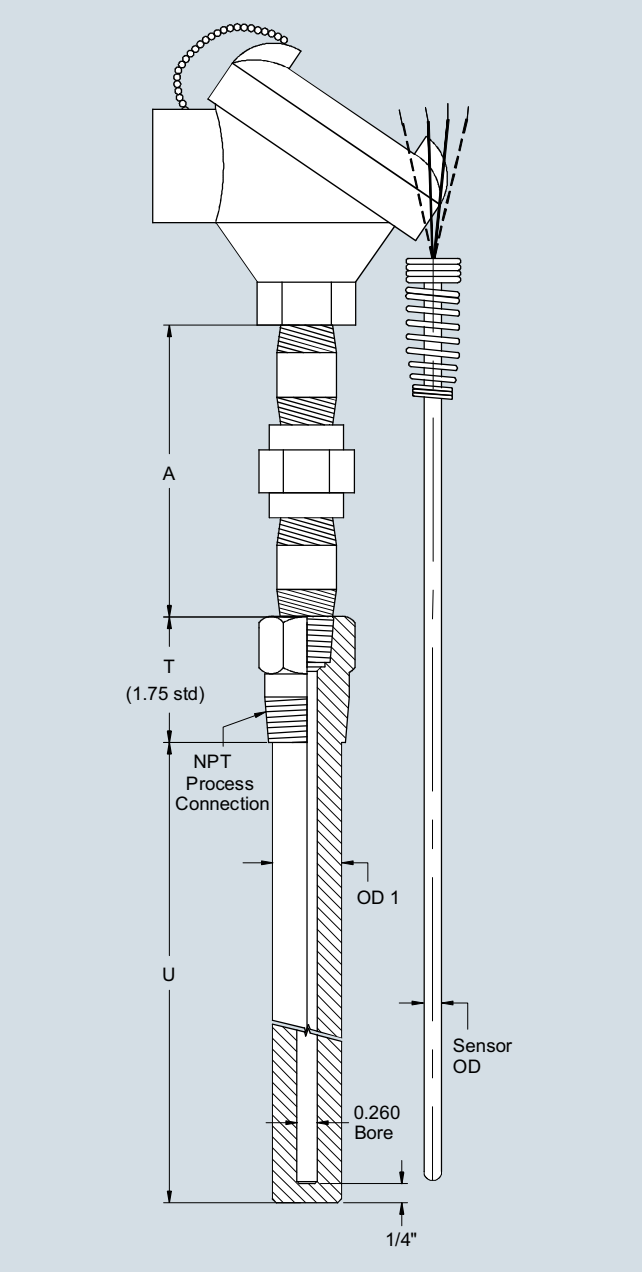
Step down threaded well assemblies



Dimensions in inch

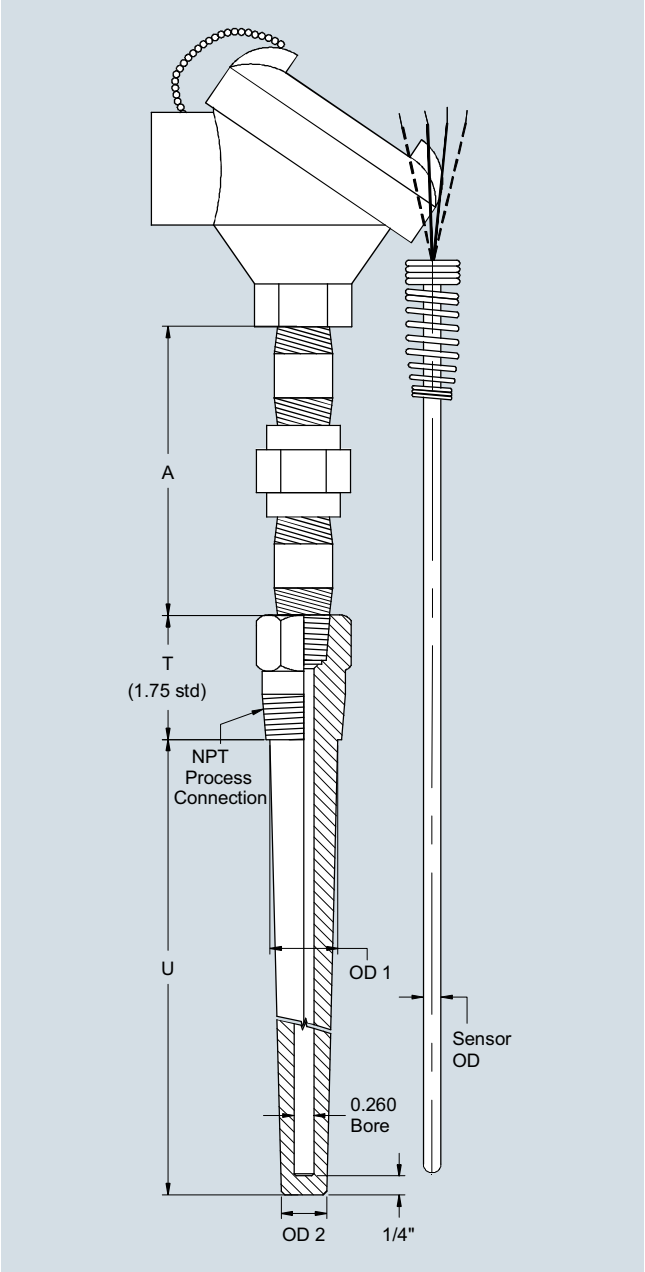
2

Straight threaded well assemblies



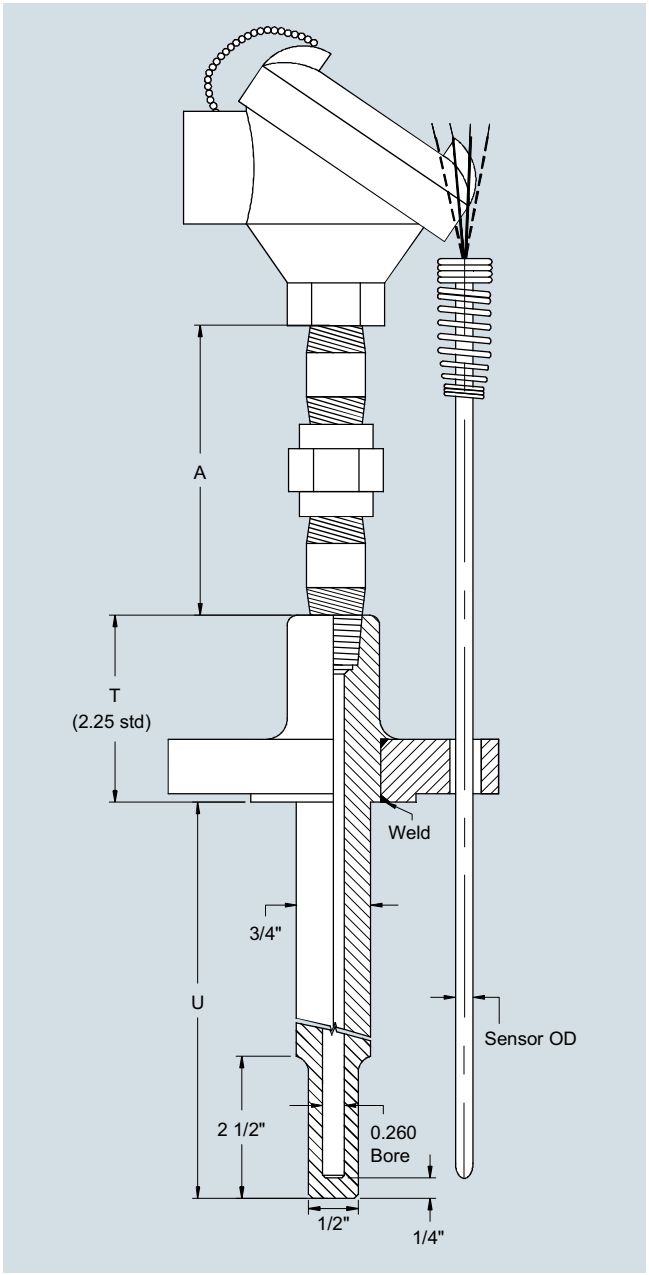
Dimensions in inch

Tapered threaded well assemblies



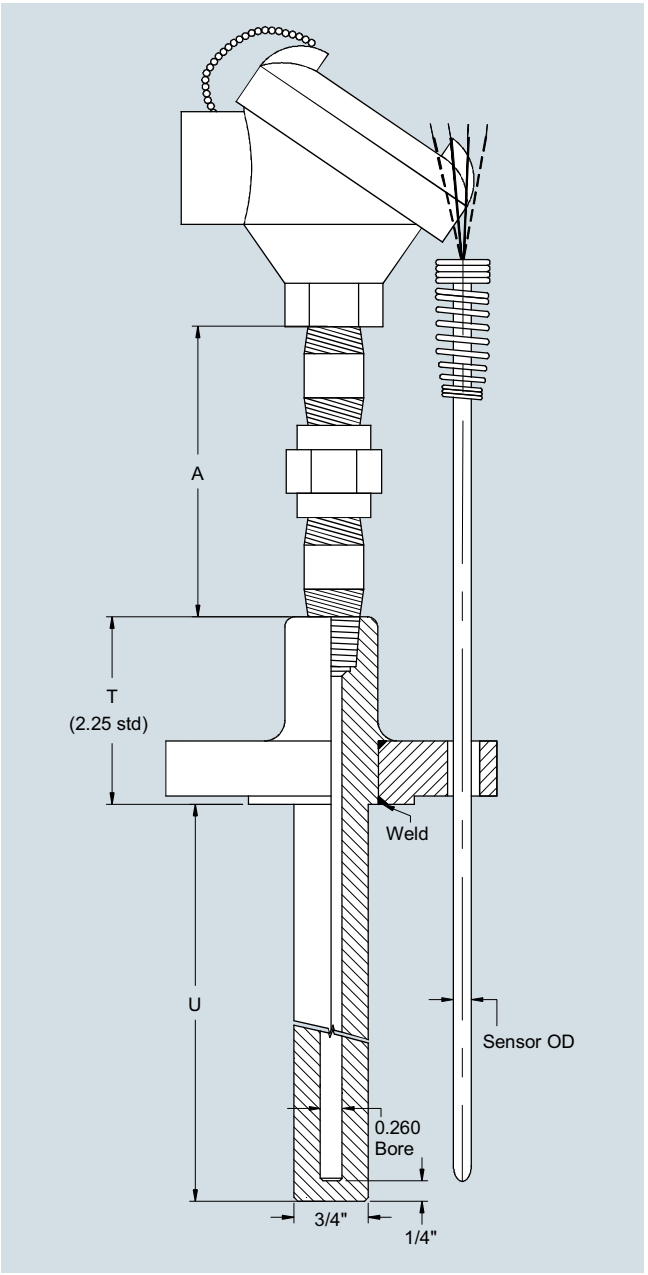
Dimensions in inch

Step down flanged well assemblies



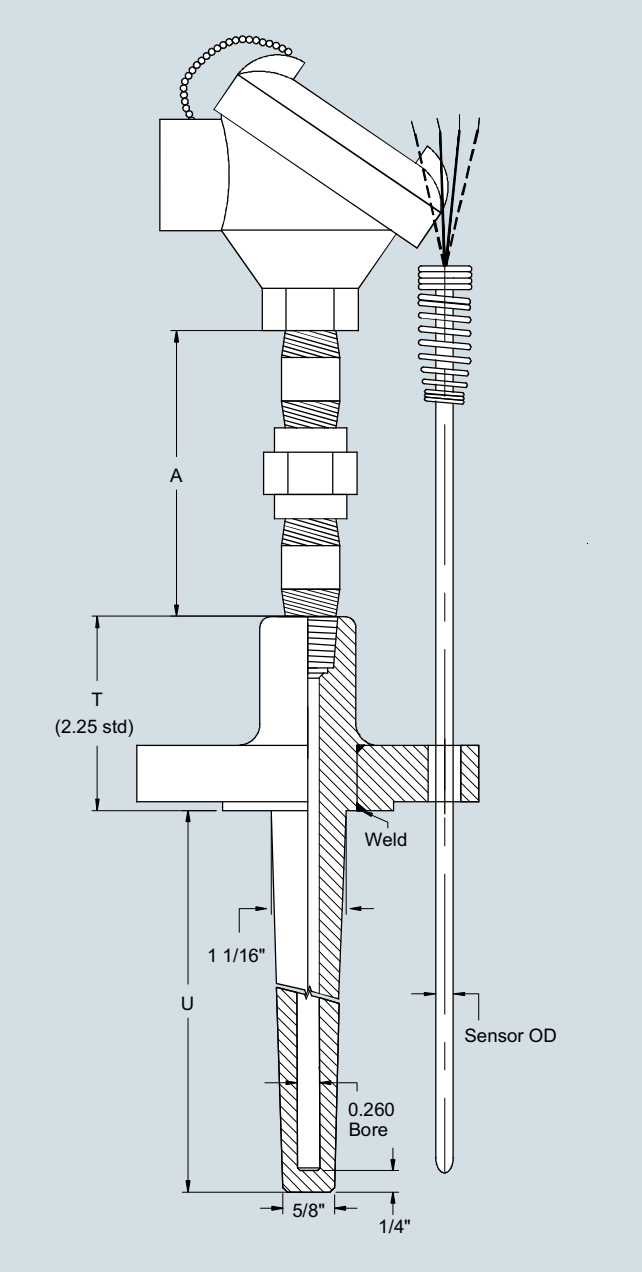
Dimensions in inch

Straight flanged well assemblies



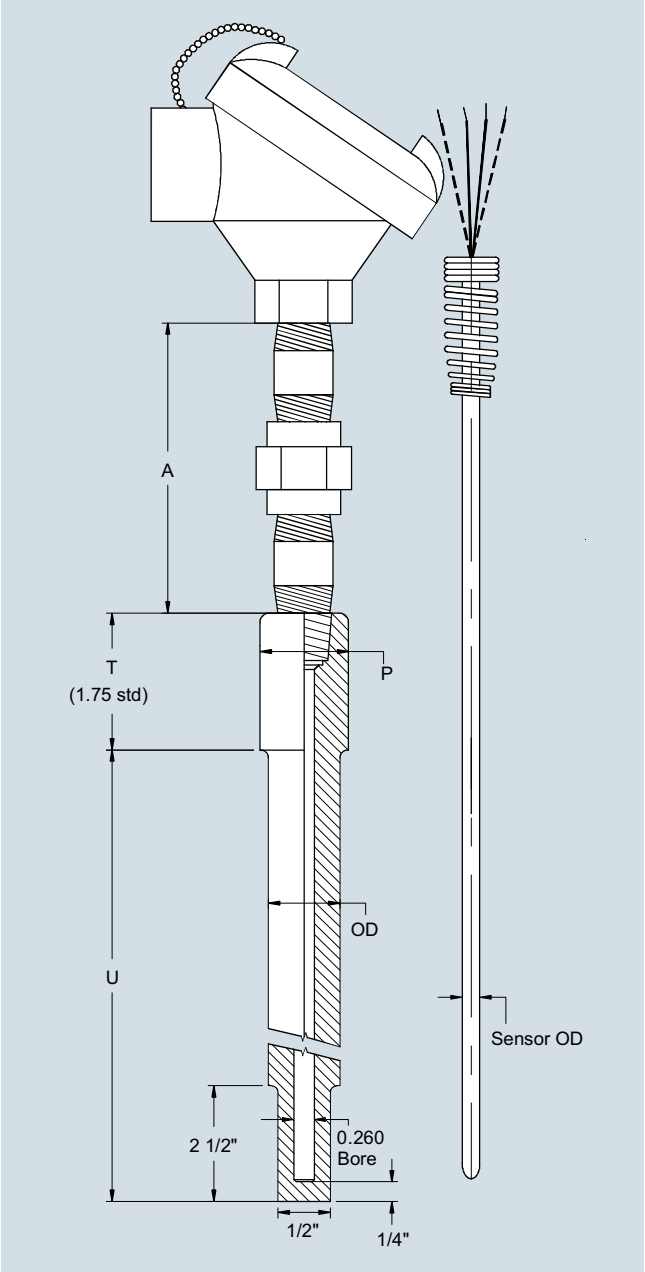
Dimensions in inch

Tapered flanged well assemblies



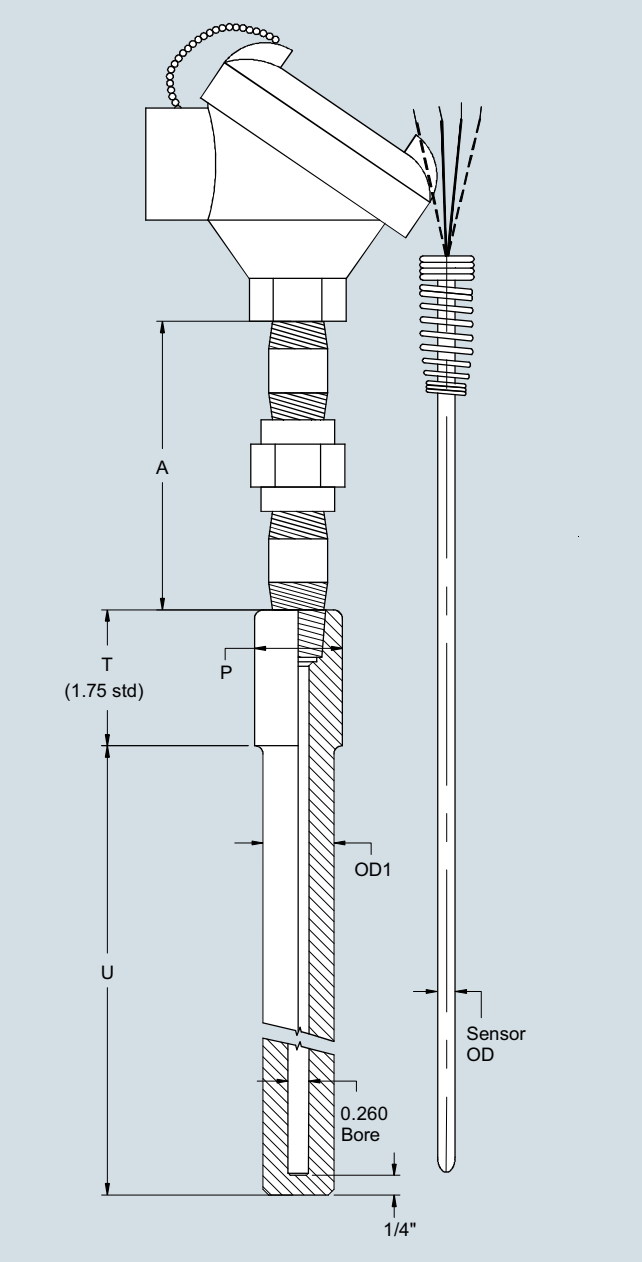
Dimensions in inch

Step down socket well assemblies



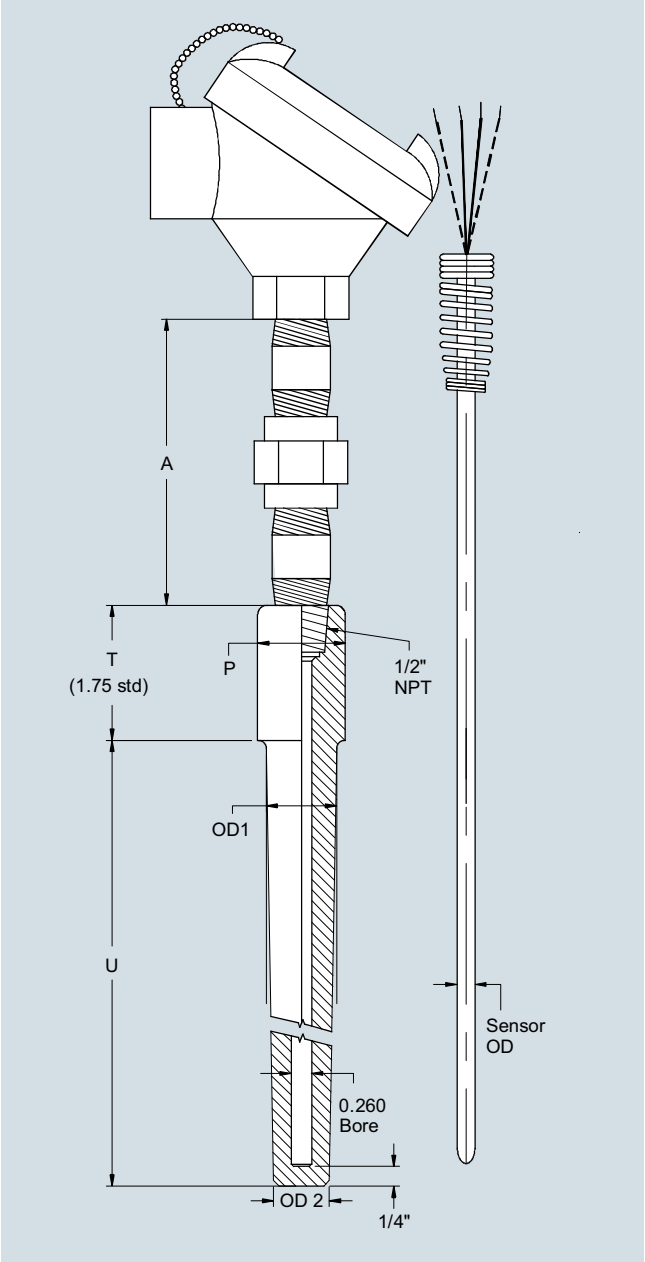
Dimensions in inch

Straight socket well assemblies



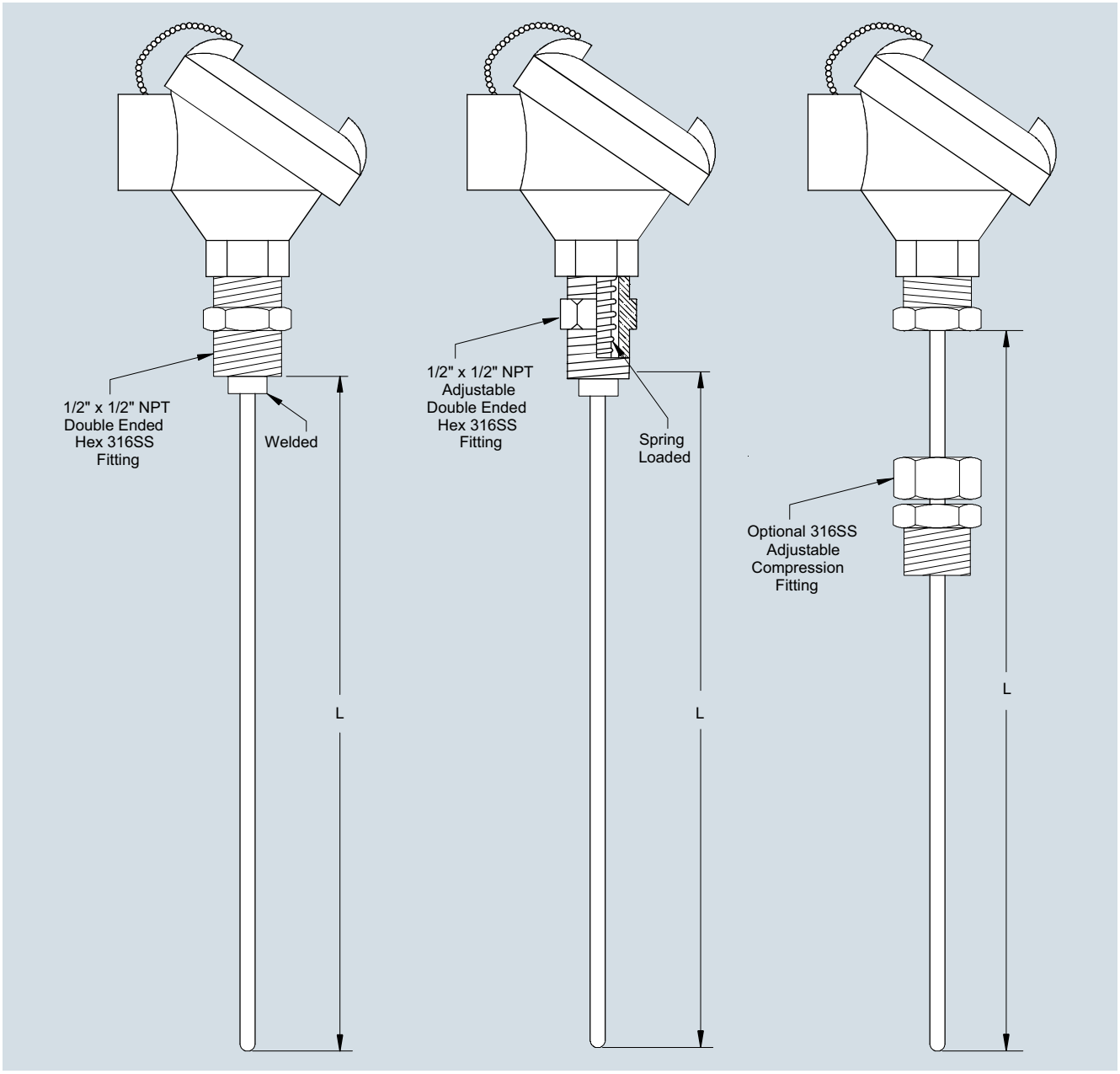
Dimensions in inch

Tapered socket well assemblies



Dimensions in inch

General purpose sensors



Dimensions in inch

Components: Connection head

Connection head

The connection head protects the connection department. The connection head features sufficient room for mounting a clamping base or transmitter.

Different connection heads are used depending on the application and preference.

Components: Measuring insert

Measuring inserts feature a large spring range. These measuring inserts are ideal for use with NPT threads with the typical loose tolerances. In this configuration, the extension function is partially or fully integrated (nipple-union-nipple). Moreover it is also possible to directly attach field devices, e.g. SITRANS TF.

Components: Transmitters

SITRANS TH head transmitters process the weak non-linear sensor signals and transmit a stable and temperature-linear standard signal, thereby minimizing sensor signal disruptions.

The transmitters permanently monitor the temperature sensors and transmit diagnostic data to superordinate systems.

Because of the low energy feed of the SITRANS TH head transmitters, self-heating of the temperature sensors can be maintained at minimal levels.

The electrical isolation and integrated cold junction ensure that temperature sensors with thermocouples provide reliable measurements at a low cost.

SITRANS TH product family

For detailed technical data on the SITRANS TH transmitters, please refer to the catalog FI 01.

- TH100 - the basic device
  - Output 4 to 20mA
  - for Pt100
  - can be configured using simple software
- TH200 - the universal device
  - Output 4 to 20mA
  - Resistance thermometer, thermocouples
  - can be configured using simple software
- TH300 - HART universal
  - Output 4 to 20 mA/HART
  - Resistance thermometer, thermocouples
  - HART conforming
  - Diagnostic functions
- TH400 - Fieldbus PA and FF
  - Output PROFIBUS PA or FOUNDATION Fieldbus
  - Resistance thermometer, thermocouples
  - Diagnostic functions; for detailed technical description of the SITRANS TH transmitter please refer to the related chapter of this catalog.

Measuring technology: Sensor elements

The diverse application spectrum for industrial temperature measuring technology requires different sensor technologies.

Resistance thermometer

Sensor elements made of other basic materials with different nominal resistances or different underlying standards are available on request. Resistance thermometers can be classified as follows:

- Basic design:
  The sensor element is built with thin layer technology. The resistance material is applied in the form of a thin layer on a ceramic carrier material.
- Versions featuring increased vibration-resistance:
  In addition to the basic design, the vibration resistance is improved through extra measures.
- Versions with expanded measuring range:
  Elements in wire-wound design. The wire winding is embedded in a ceramic body.

Thermocouples

Other thermocouples based on other thermo couples or underlying standards are available upon request.

The most common base metal thermocouples include:

- Type K (NiCr-Ni) more stable than type J, but drifts in upper range.
- Type J (Fe-CuNi) narrow application band

Measuring technology: Measuring range

The measuring range describes the temperature limits within which the thermometer can be used in a way that is meaningful for measurement purposes. Depending on the loads present, the thermowell materials and the desired accuracy levels, the actual application range for the thermometer may be smaller.

Resistance thermometer [°C (°F)]	
Basic version and increased vibration resistance	-50 ... +400 (-58 ... +752)
Expanded measuring range	-196 ... +600 (-320.8 ... +1112)

Thermocouple [°C (°F)]	
Type K	-40 ... +1000 (-40 ... +1132)
Type J	-40 ... +750 (-40 ... +1382)

Measuring technology: Measuring accuracy

Resistance thermometer

The tolerance classes of the resistance thermometers correspond with IEC 751/EN 60751:

Tolerance	**Δt**
Basic accuracy, Class B	±(0.30 °C +0.0050|t[°C]|) ±(0.54 °F +0.0050|t [°F]-32|)
Increased accuracy, Class A	±(0.15 °C +0.0020|t[°C]|) (±(0.27 °F +0.0020|t [°F]-32|))
High degree of accuracy, Class AA (1/3 B)	±(0.10 °C +0.0017|t[°C]|) (±(0.18 °F +0.0017|t [°F]-32|))

The following tables provide an overview of the scope of these tolerances. If you exceed the specified limits with a resistance thermometer, the values of the next lower accuracy class apply:

Resistance thermometer Basic version [°C (°F)]	
Tolerance	**Range**
Basic accuracy, Class B	-50 ... +400 (-58 ... +752)
Increased accuracy, Class A	-30 ... +300 (-22 ... +572)
High degree of accuracy Class AA (1/3 B)	0 ... 150 (32 ... 302)

Resistance thermometer Increased vibration-resistance [°C (°F)]	
Tolerance	**Range**
Basic accuracy, Class B	-50 ... +400 (-58 ... +752)
Increased accuracy, Class A	-30 ... +300 (-22 ... +572)
High degree of accuracy Class AA (1/3 B)	0 ... 150 (32 ... 302)

Resistance thermometer Expanded measuring range [°C (°F)]	
Tolerance	**Range**
Basic accuracy, Class B	-196 ... +600 (-321 ... +1112)
Increased accuracy, Class A	-100 ... +450 (-148 ... +842)

Thermocouples

The tolerance classes of the thermocouples correspond with IEC 584/EN 60584:

Catalog versions

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
K	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 1000 °C ±0.0075x|t[°C]| (631 °F ... 1832 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 1000 °C ±0.004x|t[°C]| (707 °F ... 1832 °F ±0.004x|t[°F]-32|)
J	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 750 °C ±0.0075x|t[°C]| (631 °F ... 1382 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 750 °C ±0.004x|t[°C]| (707 °F ... 1382 °F ±0.004x|t[°F]-32|)

Other thermocouples, ignoble

Type	Basic accuracy, Class 2	Increased accuracy, Class 1
T	-40 °C ... 133 °C ±1 °C (-40 °F ... +271 °F ±1.8 °F) 133 °C ... 350 °C ±0.0075x|t[°C]| (271 °F ... 662 °F ±0.0075x|t[°F]-32|)	-40 °C ... +125 °C ±0.5 °C (-40 °F ... +257 °F ±0.9 °F) 125 °C ... 350 °C ±0.004x|t[°C]| (257 °F ... 662 °F ±0.004x|t[°F]-32|)
E	-40 °C ... +333 °C ±2.5 °C (-40 °F ... +631 °F ±4.5 °F) 333 °C ... 900 °C ±0.0075x|t[°C]| (631 °F ... 1652 °F ±0.0075x|t[°F]-32|)	-40 °C ... +375 °C ±1.5 °C (-40 °F ... +707 °F ±2.7 °F) 375 °C ... 800 °C ±0.004x|t[°C]| (707 °F ... 1472 °F ±0.004x|t[°F]-32|)

Other thermocouples. noble

Type	Basic accuracy, Class 2	Increased accuracy. Class 1
R and S	0 °C ... 600 °C±1.5 °C (32 °F ... 1112 °F±2.7 °F) 600 °C ... 1600 °C±0.0025 x |t| (1112 °F ... 2912 °F±0.0025 x |t|)	0 °C ... 1100 °C±1 °C (32 °F ... 2012 °F±1.8 °F) 1100 °C ... 1600 °C±[1 + 0.003 (t - 1100)] °C (2112 °F ... 2912 °F±[1.8 + 0.003 (t - 212)] °F)
B	600 °C ... 1700 °C±0.0025 x |t| (1112 °F ... 3092 °F±0.0025 x |t|)	

Measuring technology: Response times

Response time describes the speed of the measurement system in the case of a temperature change, and is typically indicated as T0.5 or T0.9. The values indicate the time in which a measured value has increased to 50% or 90% of the actual temperature increase.

The main variables which affect response time are as follows:

- Ideal thermowell geometry includes:
  - smallest possible material at the tip
  - use of conductive material
- Thermal connection of measuring insert to thermowell:
  Due to the optimized design of the Siemens inserts (small gap width, spring system), they feature very good response behavior. Because of the good fit, additional contact materials are not usually required except in certain applications e.g. attachment of a surface sensor.
- Size of temperature increase
- Medium and flow rate

Resistance thermometer

Typical values as per EN 60751 in water at 0.4m/s can be found in the following table.

Thermowell form	Diameter [mm (inch)]	T0.5	T0.9
None	6 (0.24)	6	15
Straight (2)	9 (0.35)	34	90
	12 (0.47)	45	143
Tapered (3)	12 (0.47)	15	31
Barstock (4) U=65	24 (0.95)	40	100
Barstock (4)] U=125	24 (0.95)	45	110

Thermocouples

Typical values as per EN 60751 in water at 0.4m/s can be found in the following table.

Thermowell form	Diameter [mm (inch)]	T0.5	T0.9
None	6 (0.24)	2	4
Straight (2)	9 (0.35)	20	63
	12 (0.47)	19	66
Tapered (3)	12 (0.47)	7	22
Barstock (4) U=65	24 (0.95)	22	73
Barstock (4)] U=125	24 (0.95)	20	53

Measuring technology: Mounting depth

Measuring insert

Type	Temperature-sensitive length (TSL [mm (inch)]	Non-bendable length [mm (inch)]
Basic	50 (1.97)	30 (1.82)
Increased vibration resistance	50 (1.97)	30 (1.82)
Expanded measuring range	50 (1.97)	60 (2.36)
Thermocouple	20 (0.79)	5 (0.20)

Immersion depth/contact with media

Ambient conditions (temperature/climate/insulation) and the design of the thermowell, process connection and piping result in so-called "heat transmission errors".

To prevent such an error, the submersion depth and diameter of the thermowell tip will be defined. The temperature-sensitive length (TSL) of the thermowell must also be taken into account. The following rule of thumb can be used:

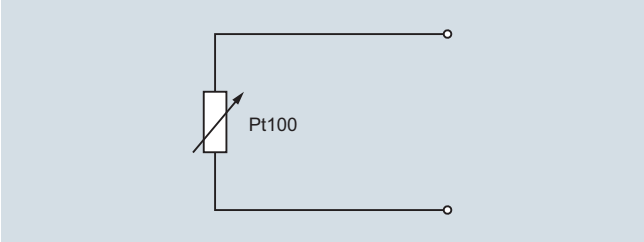
- Water
  Submersion depth ≥ TSL + 5 x Ø of thermowell
- Air
  Submersion depth ≥ TSL + 10 ... 15 x Ø of thermowell
- Recommendations
  - Select largest possible submersion depth
  - Select measuring location with higher flow velocity
  - Thermal insulation for outer thermometer components
  - Smallest possible surface for outer components
  - Insertion in pipe bends
  - Direct measurements without additional thermowell if no suitable solution can be found using other measures.

Measuring technology: Connection types

In the case of resistance thermometers, the type of sensor connection directly affects the level of accuracy:

Two-wire system

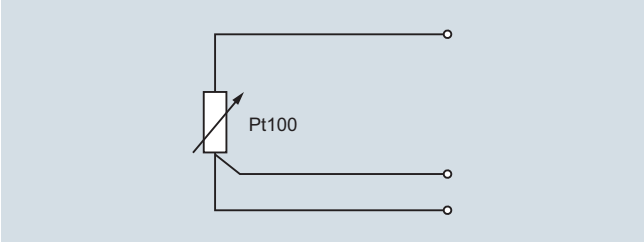
The resistance of sensor lines are included in the measurement result as an error. Adjustments are recommended in this case.



Pt100 Two-wire system

Three-wire system

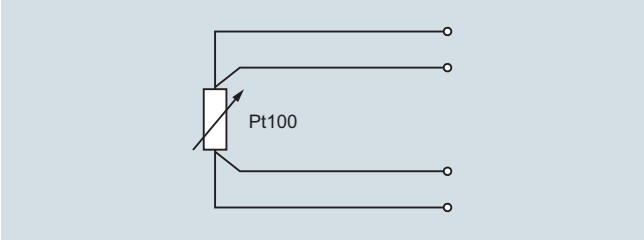
Line resistance is not included in the measurement result. Requirements: all terminal and line resistances (corrosion) are at the same level, and terminals are at the same temperature level.



Pt100 Three-wire system

Four-wire system

Line resistance is not included in the measurement result. This type of connection is the most secure and most accurate.



Pt100 Four-wire system

Siemens measuring inserts can be used to implement all types of connections for 1 x Pt100 devices. In the case of 2 x Pt100 versions, two- and three-wire systems are also possible. For measurement-related reasons, we always recommend a 1 x four-wire or 2 x 3-wire connection.

Temperature influence

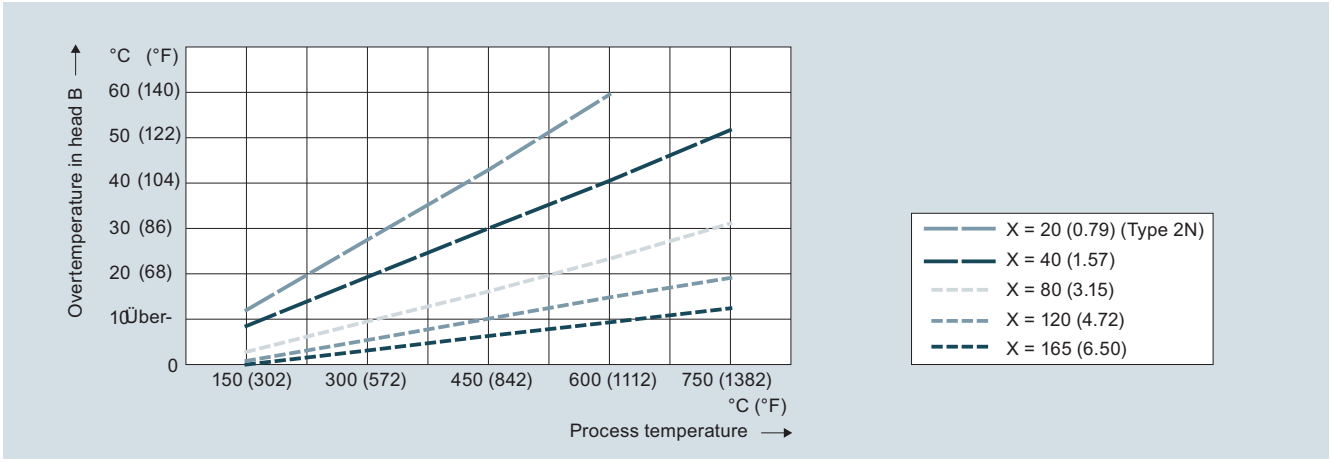
At the connection head TS500[1)]

	Without transmitter [°C (°F)]	With transmitter [°C (°F)]
Aluminum or stainless steel	-40 ... +100 (-40 ... +212)	-40 ... +85 (-40 ... +185)
Plastic	-40 ... +85 (-40 ... +185)	-40 ... +85 (-40 ... +185)

1) Notice manual at Ex-applications, please

Influence of extension

The illustration below assists you in selecting the right T length for the neck tube. In this case, the following applies: Connection head temperature = Ambient temperature + Overtemperature. The temperature in the connection head can thus be assessed as follows:



Extension length X, effect on temperature, dimensions in mm (inch)

Please note that guidance values may change due to local conditions. Please consider these potential changes particularly with respect to explosion protection.

Also note that the accuracy of the transmitter also depends on the temperature in the connection head.

Process connection/Thermowell

When selecting a process connection, the process parameters sometimes only allow a specific technology. In addition, regional standard-related and customer-specific requirements must be observed. The range of products therefore includes a broad selection of standard connections.

In the case of redesigned or newly designed facilities, it is possible to achieve cost savings by implementing various measures:

- Use of standard lengths through clever selection of screw, weld or flange sockets
- Moveable compression fittings

The temperature resistance of a material for process connections and thermowells also limits the application area of the temperature sensor. The temperature range indicated on the type plate always refers to the measuring insert, not the material which comes into contact with media. Two aspects must be considered when assessing temperature stability:

- What maximum temperature may the material reach without a load?
- What is the behavior under load?

Process load

Because of the large variety of possible applications and variables, it is not possible to make general binding statements regarding the resilience of components which comes into contact with media. The load diagrams below can be used for common applications. However, where operating conditions vary significantly, please contact our technical support team.

Load on the thermowell and remedies:

The process itself	Correction options
Temperature	Material selection
Pressure	Thermowell type
Flow velocity	Insertion length, thermowell type
Viscosity	Insertion length, thermowell type
Vibration	Support against vibration
Corrosiveness	Material selection, coating
Abrasion (e.g. carbon dust)	Sensing rod, coating

Technical description

Thermowell calculation

Properly applied load diagrams will provide a sufficient degree of safety for the most common thermowell configurations.

However, there are cases in which operating conditions deviate too greatly from standard parameters. In this case, a customized thermowell calculation may be required.

Another reason for doing this calculation is the fact that flowing media can create turbulence at the tip of the thermowell under certain conditions. The thermowell will then vibrate and may even be destroyed if not configured correctly. This is the most frequent cause of thermowell bailure.

SIEMENS offers the two recognized methods for calculating the thermowell:

- DIN/Dittrich method
- ASME/Murdock method
  This method also takes into account turbulence formation on a mathematical level.

Both methods provide a high degree of safety with regard to thermowell configuration, however, they do not provide a guarantee against breakdowns.

Materials

Material descriptions/Standards comparison				**Max. temperature [°C (°F)] (unloaded)**	**Properties**	**Applications**
Mat. No.:	AISI/Trade name:	EN 10028-2:	Description			
1.4404 or 1.4435	AISI 316 L	X2CrNiMo17-12-2	Austenitic stainless steel	600 (1112)	Good acid resistance, resistant against grain boundary corrosion	Chemical industry, waste treatment, paper and cellulose industry, food industry
1.4571	AISI 316 Ti	X6CrNiMoTi 17 12-2	Austenitic stainless steel	800 (1472)	Good acid resistance, resistant against grain boundary corrosion (supported by Ti portion)	Chemical industry, textile industry, paper and cellulose industry, water supply, food and pharmaceuticals
1.5415	A 204 size A	16Mo3	Carbon steel, high-alloy	500 (932)	Resistant at higher temperatures, well suited for welding	Steam turbines, steam lines, water pipes
1.7335	A 182 F11	13CrMo4-5	Carbon steel, high-alloy	540 (1004)	Resistant at higher temperatures, well suited for welding	Steam turbines, steam lines, water pipes
1.4841	SS 314	X15CrNiSi25-20	Austenitic heat-resistant stainless steel	1150 (2102)	Resistant at high temperatures, also resistant against low-O_2 and nitrogen-containing gases.	Flue gas, petrochemical industry, chemicals industry, power plants
1.4762	446	X10CrAl24	Ferritic heat-resistant steel	1150 (2102)	Resistant at high temperatures, in oxidizing and reducing sulphur-containing atmosphere	Chemical industry, power plants, steel industry, waste gas treatment
2.4816	Inconel 600	NiCr15Fe	Nickel-Chrome alloy	1150 (2102)	Resistant at high temperatures, resistant against chlorine-induced cold crack corrosion	Chemical industry, petrochemical industry, food industry
1.4876	Incoloy 800	X10NiCrAlTi32-21	Austenitic heat-resistant stainless steel	1100 (2012)	Excellent resistance against oxidation and carbonization at high temperatures, good corrosion resistance	O&G industry, waste gas treatment, power plants (steam boiler, heat exchanger), applications using aggressive fluids
2.4819	Hastelloy C 276	NiMo16Cr15W	Nickel-Chrome-Molybdenum alloy	1100 (2012)	Resistant at high temperatures, in oxidizing and reducing atmosphere, resistant against pitting and crevice corrosion, good corrosion resistance after welding	Chemicals industry, paper and cellulose industry, waste treatment, waste incinerators, emissions controls, shipbuilding and offshore industry
2.4360	Monel 400	NiCu30Fe	Nickel-Copper alloy	500 (932)	Excellent corrosion resistance, particularly against chlorine-induced cold crack corrosion	Chemical industry, offshore industry, nuclear technology, petrochemical industry

Where cost-intensive materials are used with flange thermowells, cost savings can be achieved by using a so-called flanged wheel. A thin disc of the material which comes into contact with media is applied prior to the flange (ordinary stainless steel).

Vibration resistance of measuring insert, cable sensor

Similar to the thermowell, inner (Karman vortices) and outer (plant) vibrations also affect the measuring insert. For this reason, a special assembly of measurement elements is required. Other than a few exceptions for cable and compact thermometers, Siemens only produces sensors based on a mineral-insulated cable. Together with precautions taken when installing the measuring element, the Siemens basic version already exceeds EN 60751 by more than a factor of 3. Pursuant to the measurement methods of this standard, the following values are obtained (tip-tip):

- 10 g: Basic version and expanded measuring range
- 60 g: Increased vibration-resistance and thermocouple

Bending ability of measuring insert/cable sensor

All Siemens measuring inserts SITRANS TSinsert are made with a mineral-insulated cable (MIC). The same applies to a portion of the cable and compact thermometer. In addition to the properties already described, another advantage of the MIC is its bending ability. This makes it possible to install these thermometers even in difficult to access areas. Please ensure that you are not below the following bending radius:

Ø MIC [mm (inch)]	R_{min} = 4x Ø MIC [mm (inch)]
3 (0.12)	12 (0.48)
6 (0.24)	24 (0.95)

Where a smaller bending radius is required due to installation conditions, subsequent testing of the insulation resistance is recommended.

Electrical stability

Insulation resistance

The insulation resistance between each measuring circuit and the fitting is tested at a voltage of 500 V DC at room temperature.

$R_{iso} \geq 100\ M\Omega$

Due to the property of the mineral-insulated cable, the insulation resistance decreases as temperature increases. Because of the special production method, it is, however, possible to achieve very good values even at high temperatures.

Line resistance

When connected to two-wire systems, the line resistance is included in the measurement result. The following rule of thumb can be used:

- ∅ Measuring insert 3 mm (0.12 inch) 5 Ω/m or 12.8 °C (55.04 °F)
- ∅ Measuring insert 6 mm (0.24 in) 2.8 Ω/m or 44.78 (44.78)

For this reason a connection to three- or four-wire systems is highly recommended.

2

Selection and Ordering data	Article No.	Ord. Code
SITRANS TS500 ↗	**7MC650**	
Threaded sensor assembly (no thermowell)	**- 0**	
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Sheath Material		
316L Stainless Steel	**2**	
310 Stainless Steel	**4**	
Alloy 600	**7**	
Form		
Adjustable Compression Fitting	**2**	
Fixed Welded	**3**	
Spring-Loaded	**4**	
Process Connection Size		
½" NPT	**J**	
Insertion length (U-Length)		
1"	**P 0**	
1.5"	**P 1**	
2"	**P 2**	
2.5"	**P 3**	
3"	**P 4**	
3.5"	**P 5**	
4"	**P 6**	
4.5"	**P 7**	
5"	**P 8**	
5.5"	**Q 0**	
6"	**Q 1**	
6.5"	**Q 2**	
7"	**Q 3**	
7.5"	**Q 4**	
8"	**Q 5**	
8.5"	**Q 6**	
9"	**Q 7**	
9.5"	**Q 8**	
10"	**R 0**	
10.5"	**R 1**	
11"	**R 2**	
11.5"	**R 3**	
12"	**R 4**	
12.5"	**R 5**	
13"	**R 6**	
13.5"	**R 7**	
14"	**R 8**	
14.5"	**S 0**	
15"	**S 1**	
15,5"	**S 2**	
16"	**S 3**	
16.5"	**S 4**	
17"	**S 5**	
17.5"	**S 6**	
18"	**S 7**	
18.5"	**S 8**	
19"	**T 0**	
19.5"	**T 1**	
20"	**T 2**	
20.5"	**T 3**	
21"	**T 4**	
21.5"	**T 5**	
22"	**T 6**	
22.5"	**T 7**	
23"	**T 8**	
23.5"	**U 0**	
24"	**U 1**	
Other, specify U length	**Z 0**	**K 1 Y**

Selection and Ordering data	Article No.	Ord. Code
SITRANS TS500	**7MC650**	
Threaded sensor assembly (no thermowell)	**- 0**	
Sensor Diameter		
¼"	**7**	
Connection Head		
Cast Aluminum	**J**	
Cast Stainless Steel	**S**	
Flip-Top Aluminum	**B**	
Explosion Proof Aluminum (FM [XP]/CSA/ATEX [Ex d])	**G**	
Explosion Proof SS	**U**	
Without Head (for TF/display, use option A80-A83)	**N**	
Other	**Z**	**P 1 Y**
Sensor Type		
RTD		
Standard RTDs are 3-wire, 100 Ohm Platinum, 500 F		
Dual RTDs are 2-wire 100 Ohm Platinum each		
Class B (+/- ### %)	**A 1**	
Class A (+/- ### %)	**A 2**	
Class AA (+/- ### %)	**A 3**	
Class B Dual	**A 5**	
Class A Dual	**A 6**	
High Vibration RTD (900 F) - Class B	**B 1**	
RTD high temp (900 F) - Class B	**C 1**	
Thermocouple		
Standard thermocouples are ungrounded		
Type J	**J 1**	
Type J dual	**J 5**	
Type K	**K 1**	
Type K dual	**K 5**	
Type T	**T 1**	
Type T dual	**T 5**	
Type E	**E 1**	
Type E dual	**E 5**	
Other	**Z 0**	**Q 1 Y**

Selection and Ordering data	Order Code
Options Add "**-Z**" to Article No. and add options, separate extensions with "+".	
Explosion protection	
ATEX Intrinsic safety "ia", "ic"	**E01**
ATEX Flameproof enclosure "d"	**E02**
ATEX Non sparking "n"	**E03**
cFMus intrinsic safety	**E11**
cFMus explosion proof	**E13**
Transmitter mounted in head Measuring range to be set must be specified with plain text data "Y01".	
SITRANS TH100 No Approvals	**T10**
SITRANS TH100 ATEX (Ex ia, Ex n)	**T11**
SITRANS TH100 FM (IS)	**T13**
SITRANS TH200 No Approvals	**T20**
SITRANS TH200 ATEX (Ex ia, Ex n)	**T21**
SITRANS TH200 FM (IS)	**T23**
SITRANS TH300 No Approvals	**T30**
SITRANS TH300 ATEX (Ex ia, Ex n)	**T31**
SITRANS TH300 FM (IS)	**T33**
SITRANS TH400 PA No Approvals	**T40**
SITRANS TH400 PA FM (IS), ATEX (Ex ia, Ex n)	**T41**
SITRANS TH400 FF No Approvals	**T45**
SITRANS TH400 FF FM (IS), ATEX (Ex ia, Ex n)	**T46**
Transmitter with display - SITRANS TF	
With SITRANS TH200 (SIPROM T communication)	
General Purpose [7NG3135-0AC10]	**A81**
XP FM/CSA (XP) [7NG3135-5AC10]	**A82**
With SITRANS TH300 (HART Communication)	
General Purpose [7NG3136-0AC10]	**A83**
XP FM/CSA (XP) [7NG3136-5AC10]	**A84**
Other temperature transmitter (TF280, TF PA, etc)	
Mounting of transmitter - Ordered separately	**A80**
Transmitter Configuration	
Specify measuring range in plain text	**Y01**
Specify HART-address (max. 8 characters) in plain text	**Y17**
Tag Number (max. 16 characters) - TF only	**Y23**
Tag Description (max. 27 characters) - TF only	**Y24**
Specify bus address in plain text	**Y25**
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**
Certificates	
Material certificate for wetted parts	**C12**
Cert SIL 2	**C20**
Cert SIL 2/3	**C23**
Factory calibration - sensor only	**Y33**
Factory cal - matched pair	**C15**
Factory cal - sensor/transmitter assembly	**Y35**
Sensor options	
Grounded T/C (std = ungrounded)	**G31**
4-wire RTD (std = 3-wire)	**R04**
Further options	
SS tag plate - wired to sensor assembly (connection head only)	**Y15**
Special option (define in plain text: "Y99:…")	**Y99**

2

Selection and Ordering data	Article No.	Ord. Code
SITRANS TS500 ↗	**7MC652**	
Barstock Thermowell Assembly	■ - ■■■■■■ - ■■■	■■■
↗ Click on the Article No. for the online configuration in the PIA Life Cycle Portal.		
Well Material		
316 SS	**2**	
Special Version (Y99 required)	**8**	
Thermowell Process Connection Type & Size		
Threaded Thermowell		
½" NPT	**1 J**	
¾" NPT	**1 K**	
1" NPT	**1 L**	
Flanged Thermowell		
1.0" 150# RF	**2 E**	
1.0" 300# RF	**2 F**	
1.5" 150# RF	**2 G**	
1.5" 300# RF	**2 H**	
2.0" 150# RF	**2 J**	
2.0" 300# RF	**2 K**	
3.0" 150# RF	**2 P**	
3.0" 300# RF	**2 Q**	
Socket Weld Thermowell		
¾" Socket Weld	**0 K**	
1" Socket Weld	**0 L**	
Other design		
Customer-specified connection (Specify in plain text)	**9 X**	**H 1 Y**
Thermowell Form		
Straight	**S**	
Tapered	**T**	
Step-Down (Reduced)	**U**	
Other, Specify themowell form, U-length and T-Length	**Z 8 8**	**K 1 Y**
Insertion length (U-Length), with standard T-length (1.75")		
2"	**1 2**	
2.5"	**1 3**	
3"	**1 4**	
3.5"	**1 5**	
4"	**1 6**	
4.5"	**1 7**	
5"	**1 8**	
5.5"	**2 0**	
6"	**2 1**	
6.5"	**2 2**	
7"	**2 3**	
7.5"	**2 4**	
8"	**2 5**	
8.5"	**2 6**	
9"	**2 7**	
9.5"	**2 8**	
10"	**3 0**	
10.5"	**3 1**	
11"	**3 2**	
11.5"	**3 3**	
12"	**3 4**	
12.5"	**3 5**	
13"	**3 6**	
13.5"	**3 7**	
14"	**3 8**	
14.5"	**4 0**	
15"	**4 1**	
15,5"	**4 2**	
16"	**4 3**	
16.5"	**4 4**	
17"	**4 5**	
17.5"	**4 6**	
18"	**4 7**	
18.5"	**4 8**	
19"	**5 0**	
19.5"	**5 1**	
20"	**5 2**	
20.5"	**5 3**	
21"	**5 4**	
21.5"	**5 5**	
22"	**5 6**	
22.5"	**5 7**	
23"	**5 8**	
23.5"	**6 0**	
24"	**6 1**	
Other, specify U length	**Z 8 8**	**K 1 Y**
Extension (A-length)		
None	**0**	
3" HUNS (standard)	**7**	
3" NS	**9**	**N 0 G**
3" NUN	**9**	**N 0 M**
3" NUNS	**9**	**N 0 N**
6" NUN	**9**	**N 9 M**
6" NUNS	**9**	**N 9 N**
6" HUNS	**9**	**N 9 H**
Other	**9**	**N 8 Y**
Connection Head		
Cast Aluminum	**J**	
Cast Stainless Steel	**S**	
Flip-Top Aluminum	**B**	
Explosion Proof Aluminum (FM [XP]/CSA/ATEX [Ex d])	**G**	
Explosion Proof SS	**U**	
Without Head (for TF/display, use option A80)	**N**	
Other	**Z**	**P 1 Y**
Sensor Type		
RTD		
Standard RTDs are 3-wire, 100 Ohm Platinum, 500 F Dual RTDs are 2-wire 100 Ohm Platinum each		
Class B (+/- ### %)	**A 1**	
Class A (+/- ### %)	**A 2**	
Class AA (+/- ### %)	**A 3**	
Class B Dual	**A 5**	
Class A Dual	**A 6**	
High Vibration RTD (900 F) - Class B	**B 1**	
RTD high temp (900 F) - Class B	**C 1**	
Thermocouple		
Standard thermocouples are ungrounded		
Type J	**J 1**	
Type J dual	**J 5**	
Type K	**K 1**	
Type K dual	**K 5**	
Type T	**T 1**	
Type T dual	**T 5**	
Type E	**E 1**	
Type E dual	**E 5**	
Other Sensor		
Other, Specify type (Q1Y = …)	**Z 0**	**Q 1 Y**
No Sensor		
For well-only configurations	**N 0**	

Selection and Ordering data	Order Code
Options	
Add "**-Z**" to Article No. and add options, separate extensions with "+".	
Transmitter mounted in head Measuring range to be set must be specified with plain text data "Y01".	
SITRANS TH100 No Approvals	**T10**
SITRANS TH100 ATEX (Ex ia, Ex n)	**T11**
SITRANS TH100 FM (IS)	**T13**
SITRANS TH200 No Approvals	**T20**
SITRANS TH200 ATEX (Ex ia, Ex n)	**T21**
SITRANS TH200 FM (IS)	**T23**
SITRANS TH300 No Approvals	**T30**
SITRANS TH300 ATEX (Ex ia, Ex n)	**T31**
SITRANS TH300 FM (IS)	**T33**
SITRANS TH400 PA No Approvals	**T40**
SITRANS TH400 PA FM (IS), ATEX (Ex ia, Ex n)	**T41**
SITRANS TH400 FF No Approvals	**T45**
SITRANS TH400 FF FM (IS), ATEX (Ex ia, Ex n)	**T46**
Transmitter with display - SITRANS TF	
With SITRANS TH200 (SIPROM T communication)	
General Purpose [7NG3135-0AC10]	**A81**
XP FM/CSA (XP) [7NG3135-5AC10]	**A82**
With SITRANS TH300 (HART Communication)	
General Purpose [7NG3136-0AC10]	**A83**
XP FM/CSA (XP) [7NG3136-5AC10]	**A84**
Other temperature transmitter (TF280, TF PA, etc)	
Mounting of transmitter - Ordered separately	**A80**
Transmitter Configuration	
Specify measuring range in plain text	**Y01**
Specify HART-address (max. 8 characters) in plain text	**Y17**
Specify measuring point description (max. 16 characters) in plain text	**Y23**
Specify measuring point text (max. 32 characters) in plain text	**Y24**
Specify bus address in plain text	**Y25**
Fail-safe value 3.6 mA (instead of 22.8 mA)	**U36**
Certificates	
Material certificate for wetted parts	**C12**
Cert SIL 2	**C20**
Cert SIL 2/3	**C23**
Hydrostatic pressure test	**C31**
Thermowell NACE cert	**C50**
Oxygen-cleaned (ISO 9001 grease-free for oxygen service)	**C51**
Inspection certificate Thermowell calculation according ASME PTC 19.3 (Murdock)	**C37**
Factory calibration - sensor only	**Y33**
Factory cal - matched pair	**C15**
Factory cal - sensor/transmitter assembly	**Y35**

Selection and Ordering data	Order Code
Full Penetration Welding for Flanged Process Connections	
Full penetration weld	**G02**
X-ray test certificate for full penetration weld	**C41**
Ultrasonic test certificate for full penetration weld	**C44**
Sensor options	
Grounded T/C (std = ungrounded)	**G31**
4-wire RTD (std = 3-wire)	**R04**
Further options	
SS tag plate	**Y15**
Special option (define in plain text: "Y99:…")	**Y99**

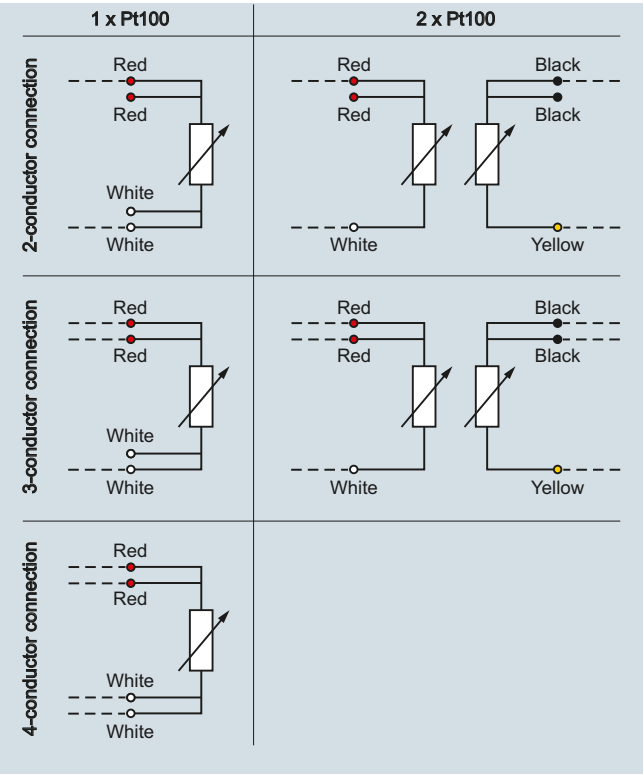
2

Schematics

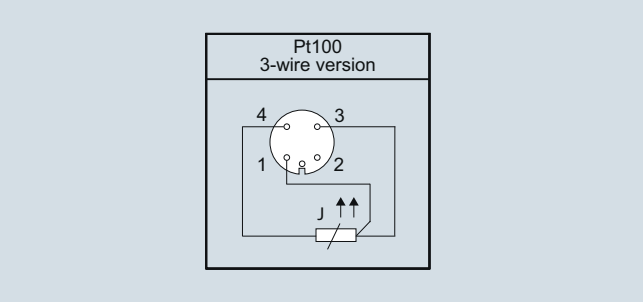
Resistance thermometer

SITRANS TSinsert measuring inserts are designed as a four-wire system for single Pt100 if not mentioned differently. This makes it possible to implement all of the aforementioned connection types.

Double Pt100 measuring inserts (for 6 mm OD only) are designed as a three-wire system.

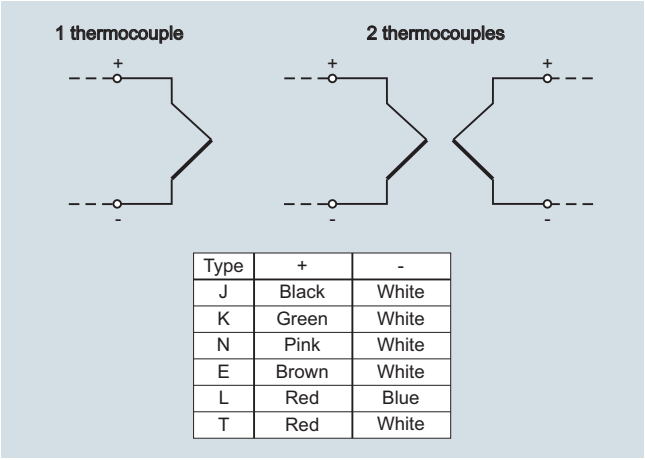


Schematics 1 x Pt100-2W up to 2 x Pt100-4W



Connection diagram for round connector M12 x 1, 4-pole

Thermocouples



Type	+	-
J	Black	White
K	Green	White
N	Pink	White
E	Brown	White
L	Red	Blue
T	Red	White

Circuit diagram for thermocouple

Where thermocouples are used, the use of head transmitters offers particular advantages: The cold junction is already integrated into the universal transmitter. There is no need for expensive thermo or extension cable. This also removes a number of possible error sources. The weak millivolt signal of the thermocouple is already converted into a stable and temperature-linear DC or bus signal on site. This drastically reduces the effects of electromagnetic factors on the measurement result.

If a head transmitter is not installed, the sensor feed line consists either of the appropriate thermo or extension leads. The thermo line is made from the thermo material of the relevant thermocouple, while the extension lead uses a cost-effective substitute material. The extension cable behaves similar to a thermo line at an electrical level, within a limited temperature range of up to 200°C.

A wide spectrum of color coding is available for thermocouples on an international level. This must be taken into account during the electrical connecting.

Country	International/ Germany			North America			UK/ Czech Republic		
Standard	Not intrinsically safe[1]			Extension lead[2]			BS 1843		
	Jacket	+	-	Jacket	+	-	Jacket	+	-
N	PN	PN	WH	OG	OG	RD	OG	OG	BU
K	GN	GN	WH	YE	YE	RD	RD	BR	BU
J	BK	BK	WH	BK	WH	RD	BK	YE	BU
T	BR	BR	WH	BU	BU	RD	BU	WH	BU
E	VT	VT	WH	VT	VT	RD	BR	BR	BU
R+S	OG	OG	WH		BK	RD	GN	WH	BU
B	GY	GY	WH	GY	GY	RD	-	-	-

1) With an intrinsically safe line as per IEC 584-3, the sheath is always blue.
2) For thermo lines as per ANSI MC96, the sheath is always blue.

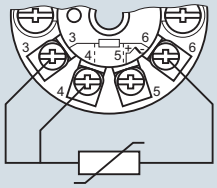
Country	Netherlands			Japan			France		
Standard	DIN 43714			ISC 1610-198			NF C42-323		
	Jacket	+	-	Jacket	+	-	Jacket	+	-
N	GN	RD	GN	BU	RD	WH	VT	VT	YE
K	BU	RD	BU	YE	RD	WH	BK	BK	YE
J	BR	RD	BR	BR	RD	WH	BU	BU	YE
T	BK	RD	BK	VT	RD	WH	OG	OG	YE
E	WH	RD	WH	BK	RD	WH	GN	GN	YE
R+S	GY	RD	GY	GY	RD	WH	-	-	-
B	GN	RD	GN	BU	RD	WH	VT	VT	YE

Abbreviation for colors				
BK: black	BR: brown	BU: blue	GD: gold	GN: green
GY: gray	OG: orange	PN: pink	RD: red	SR: silver
TQ: turquoise	VT: violet	WH: white	YE: yellow	

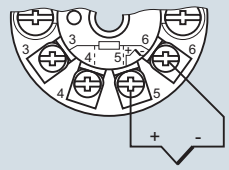
Transmitters

Where SITRANS TH transmitters are used in the connection head of the temperature sensor, connection takes place according to the following pattern

SITRANS TH100/TH200/TH300

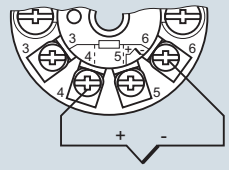


Resistance thermometer

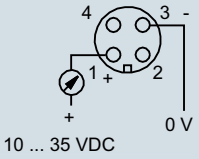


Thermocouples

SITRANS TH400



SITRANS TH100SLIM



In addition, our transmitters also allow for a large number of other possible connections (e.g. difference, average, two sensors). More information can be obtained at:
http://www.usa.siemens.com/temperature

Temperature transmitters for mounting in the connection head

Overview

The following temperature transmitters are available for mounting in the connection head:

SITRANS TH100

Programmable two-wire temperature transmitter (4 to 20 mA), without electrical isolation, only for Pt100 resistance thermometers.

SITRANS TH200

Programmable two-wire temperature transmitter (4 to 20 mA), electrical isolation for resistance thermometers and thermocouple elements.

SITRANS TH300

Two-wire temperature transmitter with HART communication (4 to 20 mA), electrical isolation for resistance thermometers and thermocouple elements.

SITRANS TH400

Temperature transmitter with PROFIBUS PA or FOUNDATION Fieldbus connection, electrical isolation for resistance thermometers and thermocouple elements.

Note:

- SITRANS TH100/TH200/TH300/TH400 can be fitted instead of the terminal block or in the high hinged cover. Additional fitting only possible in high hinged cover.
- If using intrinsically-safe temperature sensors any installed temperature transmitters must also be intrinsically-safe.

Selection and Ordering Data

Detailed information on the transmitters can be found for the respective products under "Transmitters for temperature".

Transmitter to be fitted	Order code
To order the sensor with a built-in temperature transmitter, add "**-Z**" to the Article No. of the sensor, and supplement by the following Order code:	
SITRANS TH100, only for Pt100	
• Without Ex	**T10**
• EEx ia IIC and EEx n for zone 2	**T11**
• FM	**T13**
SITRANS TH200	
• Without Ex	**T20**
• EEx ia IIC and EEx n for zone 2	**T21**
• FM (IS, I, NI)	**T23**
SITRANS TH300	
• Without Ex	**T30**
• EEx ia IIC und EEx n for zone 2	**T31**
• FM (IS, I, NI)	**T33**
SITRANS TH400 PA	
• Without Ex	**T40**
• EEx ia	**T41**
SITRANS TH400 FF	
• Without Ex	**T45**
• EEx ia	**T46**
• Customer-specific setting of the built-in transmitter (specify settings in plain text)	**Y11**